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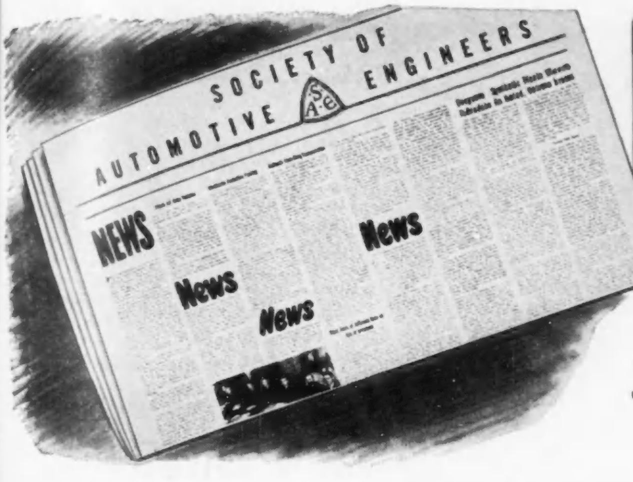

News.. ..OF THE SOCIETY

T & M 2-Way Radio Problems Undergoing Thorough Probe

HAVING established general criteria for adapting two-way radio to fleet operation, the Radio Communication Committee of the SAE Transportation & Maintenance Technical Committee has initiated action on the major individual problems requiring extensive investigation. A program planned by the Committee at a recent meeting assigned top priority to: size and shape of the radio unit, battery capacity, antenna installation, and selective calling.

Size and Shape Determination

The major consideration in determining the size and shape of the unit, the Committee has determined, is the available space for installations in both passenger cars and trucks. Since high cost and limited demand would prevent vehicle manufacturers from making specific provision for two-way radio installation, the Committee is deliberating the advisability of using odd shapes to fit the available space. But lack of uniformity in requirements of the various vehicles introduces a further complication.

Locations proposed, such as glove compartments and positions aft of the rear seats in passenger cars, have been ruled out. Demands at present are for larger glove compartments and an installation at the rear seat would block vision. Mock-ups of proposed unit shapes and sizes will be provided by several committee members at the next meeting. These specimen units will be placed in various relative positions to determine the best arrangement for the space available.

To determine the approximate battery capacity for various conditions encountered in service, Chairman W. C. Baylis, New York Power & Light Corp., has sent a questionnaire to a number of fleet operators requesting information on: (1) percentage of time the radio is turned "On" while the engine is running and the generator charging, and (2) percentage of time the radio is turned "On" with the engine not running. An added drain on the battery, in some cases, it was pointed out, will be the installation of a two-way radio in vehicles already equipped with an entertainment radio as the latter are becoming increasingly popular with drivers.

Perplexing in the installation of a passenger car antenna is the method of effecting such an installation without disturbing the upholstery. Radio engineers have suggested mounting the antenna through the middle of the turret top, while J. H. Little, Chevrolet Division, General Motors Corp., has suggested incorporation of a blister to distribute the load. Specimen body panels will be exhibited at the next meeting to aid in the solution of the antenna problem.

The fourth phase of the overall project now under way, selective-calling systems and equipment, is being investigated by a subcommittee composed of D. S. Bond, Radio Corp. of America, chairman; C. F. Meyer, General Electric Co., and L. P. Morris, Galvin Mfg. Corp. A preliminary report submitted by this group outlines its scope and objectives as follows:

1. Consolidate data to be obtained from user members of the Committee on system installations, operating features, and desired performance quality.
2. Obtain information from producers and users on present and past selective-calling systems.
3. Make recommendations to the Committee on electrical power equipment design to utilize selective-calling equipment to best advantage.
4. Correlate its activity with the Radio Manufacturers Association and users to arrive at recommendations based on high performance standards and good engineering practice.

Two-way radio is expected to aid fleet operation by reducing operating costs through better utilization of vehicles and crews and reduction of mileage. This equipment will also be valuable to public utility companies, ambulances, physicians, taxi cabs, fire departments, and other commercial vehicle and passenger car operators.

SAE Board Expands Technical Activity

CONTINUING its rapid pace in realigning technical committee activity to meet peacetime demands of industry and Government, the SAE Technical Board is speedily initiating new projects and approving the continuation of various wartime committees which can render further valuable service.

Among the new projects given the green light by the Board recently are development of recommendations on the provisions for mountings to be made on license plates and a study of spark arresters and associated problems. Expanded and more intensified activity of committees on brakes, screw threads, torsional vibration, and tractors also has been generated.

License Plate Mountings

Standardization of license plates is being worked upon by the American Association of Motor Vehicle Administrators and, in order to arrive at a satisfactory set of provisos, information is needed on vehicle plate mounting provisions. An SAE committee has been assigned to make recommendations with respect to mountings to the AAMVA.

Fire Arresters

Lack of effective measures for elimination of fire hazards, such as spark arresters, constitutes a serious deficiency in tractors, trucks, and buses. Operations in the vicinity of inflammable materials as in heavily wooded forests and near fueled aircraft demand treatment of the vehicle to render it incapable of generating fires. A committee will be set up to delve into the entire fire-prevention problem.

Brake Problems

Reorganization of the Brake Committee under a newly appointed chairman, T. P. Chase, General Motors Corp., has been sanctioned by the Board to provide for balanced membership covering areas of brake engineering under all phases of manufacturing, operation and maintenance, and Government regulatory agencies in both the ground vehicle and aircraft fields.

Illustrative of the types of projects on tentative subjects within the scope of the Brake Committee's activity are the following:

1. Standard method of measuring stopping distance,

2. Method of test and presentation of data on brakes without reference to the brake application to a specific vehicle,

3. Mechanical instrumentation for the enforcement of brake regulations,

4. Uniform sequence of tests to determine performance of brakes as used by operators,

5. Development of important factors in performance tests related to a service stop,

6. Brake rating.

Screw Threads Surveyed

Expansion and realignment of the membership of the Screw Threads Committee has been voted by the Board to increase the Committee's effectiveness in expression of the automotive users' viewpoint in development of screw thread practices. This action was taken following completion of a careful review of the overall screw thread situation conducted by a study committee appointed by the Board consisting of G. Carvelli, Wright Aeronautical Corp., W. L. Barth, General Motors Corp., and H. A. Marchant, Chrysler Corp.

Among the projects meriting early consideration in the opinion of this group are:

- Development of a new thread series with an allowance for metal-to-metal clearance between external and internal threads. This new classification should eliminate or minimize galling and seizure in high-cycle wrenching, provide clearance when plating is required, allow for high temperature requirements, and establish practical limits for larger diameter coarse pitch thread assembly.

- Eliminate nonuniformity of minor diameters of internal threads. Recommendations representative of automotive opinion should be developed in anticipation of such an undertaking by other national groups.

- Investigation of reported interference between the crest of the external thread and the root of the internal thread on eccentric assemblies of the two components.

- Preparation and issuance of a comprehensive manual on American screw thread practice to include only screw thread data and to be consistent with practices and standards endorsed by American industry through American Standards Association Sectional Committees.

Torsional Vibration

The Torsional Vibration Committee will continue to cooperate fully with the Navy through completion of a report on the Annapolis instrument tests, issuance of a progress report on torsional vibration specifications to the Navy, and initiation of means for inspecting and compiling war casualty data as influenced by torsional vibration.

Tractor Activity Continued

Formal approval of the Tractor Technical Committee to succeed the Tractor War Emergency Committee was given by the Board to study peacetime problems peculiar to the tractor industry.

Standards Work Realigned

Divisions of the former General Standards Committee discontinued by the Board are the Passenger Car and Production Divisions. The Non-Metallic Materials Division is continued as the Non-Metallic Materials Committee. A new Engine Committee will be formed to carry on the work of the former Diesel Engine and Gasoline Engine Divisions.

Appointments approved by the Board include:

- W. D. Bixby, United Parcel Service of N. Y., as chairman of the T & M Technical Committee to succeed E. N. Hatch who is Vice-President for T & M Activity.
- L. A. Danse of General Motors Corp. as SAE representative on the Industrial Advisory Council to the Federal Specifications Board.
- F. . Glynn of American Telephone and Telegraph Co. as chairman of the Standard Nomenclature Truck Committee.

SAE-ASTM Group Gets Navy Ordnance Award

THE Navy Ordnance Development Award has been given to Technical Committee A, joint committee of the SAE and the American Society for Testing Materials.

Granted in recognition of distinguished service in research and development of Naval Ordnance, the Award was accompanied by a letter to Committee Chairman W. J. Courtney from Rear-Admiral G. F. Hussey, Jr., Chief of Naval Ordnance. Expressing the Navy's appreciation for the Committee's outstanding war achievements, Admiral Hussey wrote:

"The congratulations of the Bureau of Ordnance are extended to every man and woman of Technical Committee A for outstanding performance in connection with the research, and development of research and formulation of specifications, methods of testing, and definitions of terms pertaining to rubber, rubber-like materials and products therefrom, including research concerning the properties of such materials and products.

"The Certificate for Distinguished Service to Naval Ordnance Development and the lapel emblem for each member of your organization connected with the particular developments referred to above are the symbol of appreciation from the Bureau of Ordnance and the entire Navy for the aggressive and competent manner in which you have carried out this project." Members of Technical Committee A are: (Alternates listed in parentheses) E. J. Kvet (K. W. Stevens), C. E. Zwahl (C. F. Orloff), Chairman W. J. McCortney (J. C. Dudley), J. Kirschner (H. A. Winkelmann), H. L. Ebert (C. G. Cashion), J. L. McCloud (Vice-Chairman J. P. Wilson), W. M. Phillips (A. J. Kearfott), G. H. Swart (Merle Sanger), A. W. Carpenter (C. W. Brees), Secretary E. G. Kimmich (M. J. DeFrance), J. G. Gagnon (J. M. Jackson), H. E. Wening (J. E. Feldman), M. H. Stalker, S. R. Doner (W. L. Sturtevant), J. N. B. Miller, M. Achterhoff (J. F. McWhorter), H. W. Mohr (R. E. VanDeventer), B. H. Steinfeld (C. H. Zieme), H. E. Churchill (J. M. Gauss), L. M. Peterson, G. Reinsmith, Lt. G. W. Ewald, Lt. D. C. Thompson, Bureau of Ships, represented by R. E. Harmon (E. A. Bukzin), J. D. Morron (Paul Viehl), Lyle Calkins, B. Clements (D. L. Garland), and J. H. Doering.

AMS Reorganization Geared for Efficiency

REORGANIZATION of the Aeronautical Material Specifications Subdivision of the SAE Aeronautic Committee (formerly the Aircraft Materials and Processes Coordinating Subdivision) has been effected to increase its value to industry and Government in the swingover from war to peacetime operations.

Major change is abolition of the separate Airframe, Engine, and Accessory Committees and merging of these groups into one large committee. A Coordinating Committee for the entire activity will act as an executive committee in steering and guiding the policies of the subdivision. The working groups will function as AMS Commodity Committees in establishing continuity in the processing and revision of AMS referred to them by the AMS Subdivision. Greater efficacy will be achieved, it is anticipated, through product-wise project handling rather than by the former method of component groupings.

The AMS Coordinating Committee will consist of a chairman and four vice-chairmen – one from each phase of the industry, namely, airframes, powerplants, accessories, and a new addition to the activity, airline operation. The functions and duties of each vice-chairman are:

1. Develop and maintain group interest in the work and activities of the AMS Subdivision,

2. Direct and guide development of AMS to provide maximum usage and benefit to the aircraft industry and Government as a whole,

3. To advise the subdivision chairman on appointment of competent and qualified subdivision personnel,

4. To coordinate and direct the editing of AMS to effect standardization in form, wording, and arrangement,

5. To ensure representation of each group at AMS commodity committee meetings.

Commodity committees have been set up for the following projects: Plating and Protective Coats, Synthetic Rubber, Aluminum and Magnesium Alloy Products, Plastics, Aluminum and Magnesium Castings, Nonferrous Metal Products, Carbon Steel Products, Corrosion-Resistant Steel Products, and Low Alloy Steel Products. In addition, new committees have been added on Heat-Resistant High Density Alloys and on Petroleum Products.

The Heat-Resistant High Density Alloys Committee looks forward to alleviating problems now facing the industry on materials

for jet and turbine powerplants. It is planned to coordinate all available information on heat-resistant alloys to serve as a basis for developing specifications covering materials required by airplane manufacturers for jet and turbine installations as well as the products that make up the powerplant.

Membership of the commodity committees will be modified to suit the particular problem on hand, although the chairmanship will be permanent. However, all subdivision committee members and interested suppliers are invited to attend all commodity committee meetings and actually function as members during discussions.

The first major task facing the AMS Subdivision is screening of existent Aeronautical Material Specifications to separate the current from the non-current specifications to facilitate the usage of AMS. Those materials determined to be non-current will be so designated in the AMS index and the information disseminated to the industry.

Serving as members of the Coordinating Committee are: Chairman J. B. Johnson, Army Air Forces; vice-president for airframes, L. D. Bonham, Lockheed Aircraft Corp.; vice-president for powerplants, B. Clements, Wright Aeronautical Corp.; vice-president for accessories, A. W. F. Green, Allison Division, General Motors Corp., and vice-president for airline operation, G. K. Brower, American Airlines, Inc.

Chairmen of the commodity committees selected are: W. C. Schulte, Curtiss-Wright Corp., Propeller Division; A. W. F. Green, Allison Division, General Motors Corp.; R. R. Janssen, North American Aviation, Inc.; L. D. Bonham, Lockheed Aircraft Corp.; G. T. Williams, Pratt & Whitney Aircraft, Division of United Aircraft Corp.; R. J. Metzler, Breeze Corporations, Inc.; C. E. Carrigan, Ranger Aircraft Engines; R. E. Pelzel, Douglas Aircraft Co., Inc.; B. Clements, Wright Aeronautical Corp., and G. K. Brower, American Airlines, Inc.

Improved Ignition Seen as Flight Aid

CHANGES in aircraft ignition systems which, it is hoped, will improve engine operation and materially reduce maintenance problems are being considered for study by the SAE Ignition Research Committee.

Under the Committee's examination are numerous new ignition devices and improvements to existing equipment which show evidence of bettering aircraft operation and maintenance. Among the projects under surveillance of the group are:

1. Unconventional methods of firing the cylinder charge.
2. Advanced ignition cable design.
3. Elimination of spark-plug sticking problems.
4. Improved spark-plug terminals.
5. Ignition analyzers.

Consensus of the aircraft industry is that present ignition systems have reached their limit of effectiveness with present high power engines and that new or greatly improved design is necessary for anticipated higher horsepower engines.

Indications are that methods other than conventional spark-plug ignition can effec-

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A-N Board Praises SAE Aero War Job

INCREASE in ANA standards from 50 in 1941 to 2100 specifications, drawings and bulletins published up to the present time "was made possible, to a considerable degree, through the contributions of the Aeronautics Division of the SAE," according to a letter received recently by the Society from Capt. G. B. H. Hall, Navy member, and Col. H. G. Montgomery, Jr., Army member of the Working Committee of the Aeronautical Board.

Amplifying that evaluation of the SAE's war job in the area of aeronautical standards and specifications, the officers wrote:

"In the months preceding, and throughout, the recent period of world hostilities, the SAE Aeronautics Division volunteered its services to the Working Committee of the Aeronautical Board in its

Capt. G. B. H. Hall, U. S. Navy

effort to increase aircraft production, simplify stocking and supply, and facilitate maintenance through the Army-Navy standardization program.

"The Working Committee takes pleasure in acknowledging this assistance as a definite contribution to the war effort and desires to express its appreciation hereby. At the start of hostilities in 1941, there were in existence less than 50 ANA standards, and most of these were not regarded too highly by industry. At present, there are more than 2100 ANA specifications, drawings and bulletins published, and generally respected by industry. This accomplishment was made possible to a considerable degree, through the contributions of the Aeronautics Division of the Society of Automotive Engineers.

"It is trusted," Capt. Hall and Col. Montgomery conclude, "That this cooperation will not cease now that hostilities are over but rather, will continue on an even greater basis."

Col. H. G. Montgomery, Jr. U. S. Army

ENGINEERIN

Investigation of Enemy Arms Aided Army Ordnance Program

Digest of paper

by LT.-COL. C. H. COREY

U. S. Army Ordnance

(Paper entitled, "Technical Investigations of German Automotive Materiel")

SENDING Technical Intelligence Teams composed of specially qualified officers and men to all combat theaters during the war to obtain advance information of new or unusual enemy weapons represented a difficult but successful Army Ordnance Department operation in the effort of keeping our armament superior to that of the enemy, Col. Corey declared.

This program required the closest possible cooperation of Ordnance, industry, and science in order to evaluate every step of enemy scientific achievement and to exploit all possible sources of scientific ideas. It was further necessary to obtain a knowledge of the weapons which the enemy had produced, were producing, and planned to produce.

The Combined Intelligence Objectives Subcommittee, known as CIOS, was organized by the combined Chiefs of Staff with the objective of obtaining information in the many fields of German technical intelligence. It was, he related, an instrument whereby British and American agencies could pool their target intelligence, investigate targets on a combined basis, and share the results. In an effort to obtain the best qualified personnel for CIOS investigations, the Ordnance Department tried to obtain the services of civilian employees of private industry which were engaged in the production or development of Ordnance materiel. Nationally recognized organizations such as the SAE assisted the Ordnance Department in selecting these technicians by providing recommendations of individuals who were best qualified for the job and available for overseas assignments.

It is probably a fact that never before has a defeated nation been so thoroughly investigated politically, industrially, and scientifically as Germany, Col. Corey observed. Tons of reports have been, and are still being written on the results of such investigations. The papers presented by automotive specialists who were members of Technical Intelligence teams, just one phase of the over-all operation, offer the technical aspects of German automotive developments.

Odd Vehicle Engine Devices Useless in Combat Operation

Digest of paper

by MAURICE A. THORNE

General Motors Corp.

(Paper entitled "German Army Vehicle Engines")

ENERGETIC activity and enormous accomplishment in the development of German Army vehicle engines resulted in unusual designs, although German operational engines were generally inferior to our own in point of dependability and relative freedom from troubles.

In this field of engine design, as in others, there were many highly skilled engineers with unusual technical abilities who were willing to undertake the design of any device which indicated some possibility, regardless of the technical complications. As a consequence, many odd and novel devices were perpetrated, some of which were valuable developments.

Before a study of engine developments can be made, an understanding of the fuel situation, a dominant influence affecting engine selection and design, is essential to clarify moves that might otherwise be obscure. Prior to the war, one third of Germany's fuel requirements was supplied by the synthetic oil industry with imported crude petroleum furnishing 60% and domestic fields 7%. By 1944, synthetic production represented 80% of all petroleum products. Synthesized gasoline cost four to five times as much as gasoline refined from natural petroleum, although the cost in money was of minor importance compared to costs in terms of labor.

Since continuance of the war depended on adequacy of supply, high cost of fuel synthesis, lowering of reserve stocks, and intensified bombing of oil plants combined to accentuate the importance of fuel economy and the use of more economical engines. As a consequence, a diesel engine program was initiated.

Several firms were selected to develop diesel engines for tanks. The major advantages mentioned for diesel engines as compared with gasoline engines were:

1. Superior fuel economy at all loads,
2. Reduced fire hazard due to characteristics of fuel and engine,
3. Higher torque at low speeds in view of the fewer transmission ratios required,
4. Engine operation unaffected on side hills and slopes,
5. Greater dependability,
6. Easier cooling.

The major disadvantage was the greater relative size, particularly objectionable due to the effect of increasing tank weight and size. Air cooling was considered most desirable in view of its greater adaptability to extremes of temperatures, among other reasons.

Investigations REVEAL Ground Vehicle DEFECTS Speeded WEHRMACHT COLLAPSE

(On the following 13 pages are summaries of the most technical points revealed in a series of papers evaluating technical wartime development in German ground vehicles. These papers were written by members of Technical Intelligence teams, which recently visited Germany under the auspices of the U. S. Army Ordnance Department. A complete set of the full text of these papers is available from SAE Special Publications Department— 11 papers at $2.75)

At the war's end, a 12 cyl, aircooled diesel engine was substituted for the 8 cyl, water-cooled gasoline engine in the 8-wheeled armored car. The 38T light tank, manufactured in small quantities, was equipped with an aircooled diesel engine. Had the projected production program for midyear 1945 gone into effect, a diesel engine would have been used in vehicle models constituting 75% of production. However, production was seriously delayed by attendant tooling difficulties in converting to aircooled diesels.

Among numerous interesting engines in production or development was the Maybach HL-230 water-cooled, V-12 gasoline engine, the most highly developed engine in current production at the end of the war. The HL-234 engine, a modified version of the HL-230 with a provision for direct injection, represented the maximum in the development of gasoline engines for German military vehicles. Relatively minor changes to the basic engine were made, such as new heads for provision of injection nozzles and opening up of valves, porting and induction piping to improve scavenging and breathing. The acceptance rating was increased from 650 hp for the HL-230 to 850 hp for the direct injection HL-234. Supercharging was tried, but the resultant increase in power did not warrant the added complication of a blower.

The crankshaft of the HL-230 type of engine was supported in seven large roller bearings. Bearing troubles reported were due, it was felt, to the occasional necessity of using light oil in hot weather when distribution of heavy summer weight lubricating oil was delayed. Cylinders were on very close centers and very little metal was left after machining for the rubber-sealed wet liners. Some leakage trouble was experienced.

Another engine, in the developmental stage, was an "X" form, aircooled 16 cyl diesel engine, considered ideal for tanks by its designer. It was an outgrowth of a previous 10 cyl engine, chosen as an alternate for existing aviation and marine engines used in the 200 ton Maus tank. It was reported to develop 1500 hp which would have provided a power-weight ratio far short of the 20-25 hp per ton ratio considered desirable by the military.

A diesel unit to be interchangeable with the aircooled gasoline engine in the Volkswagen was being designed. It was to be a two-stroke, aircooled, horizontally-opposed, two cyl engine, with a 70 cu in. displacement. A blower was to be used and it was expected to develop 25 hp at 2500 rpm. One glow plug per cylinder was fitted for starting.

One of the diesel producers was instructed to design and develop a large aircooled diesel engine developing 700 net hp, suitable for use in heavy tanks. The director of engineering of the concern concluded, after a detailed study of tank requirements, that the engine should be a two-stroke, valveless, V form engine, simple for ease of servicing and low cost production, and water-cooled. His experience indicated that the maximum power obtainable with an aircooled cylinder of 2.3 liters capacity was 50 hp. A 750 hp engine would require 16 cyls of 2.3 liters capacity, making necessary an "X" arrangement.

To avoid an "X" arrangement, which would have been difficult to service and very large and complicated, he decided that the engine should be a 90 V-8, with 4 liters capacity cylinders and water-cooled. A two cyl, two-stroke auxiliary diesel engine was to be mounted on the main engine in order to start the main engine, drive the generator and cooling fans, and propel the vehicle in an emergency. Prototype engines were in the process of construction although none were completed.

Still another configuration being developed was an oil-cooled engine as a preferred alternate for direct air cooling. In one arrangement, an aluminum cylinder head was direct aircooled and the cylinders were cooled by oil circulated at a high velocity from bottom to top of thin annuluses formed by the wet liners and the walls of the cylinder block. The advantages claimed for oil cooling were quicker warm-up and more uniform cylinder wall temperatures.

Progress on these and other vehicle engine projects appeared to be slow. It was evident, however, that combat vehicle engine design activity lacked the feverish and impelling urge of aircraft engine development largely because of diversion of talent to fields of more critical needs.

■

Transmission Design Gadgetry Proved Below Par in Field

Excerpts from paper

by R. R. BURKHALTER

Spicer Mfg. Corp.

(Paper entitled "German Automotive Transmission Systems— Development and Design")

COMPLEX transmission designs were prevalent in German vehicles, as any feature anticipated to improve operational advantage was incorporated regardless of extravagant use of ball and roller bearings or man-hours labor required for production. Most of the original designs were made under the disguise of switching locomotives and it

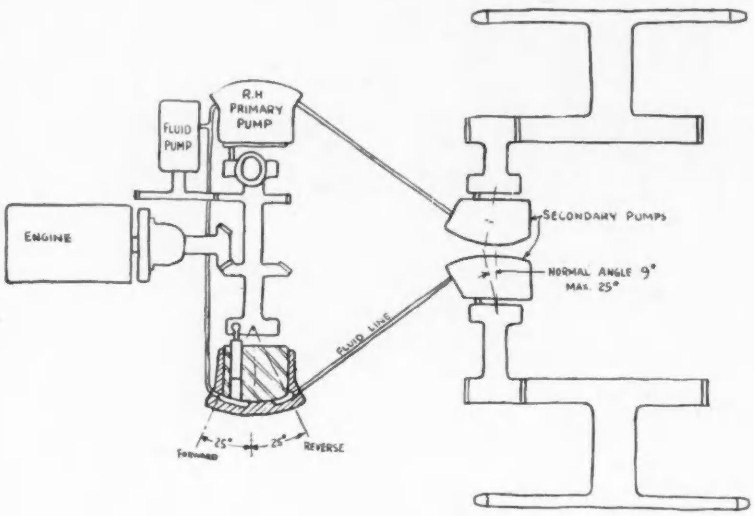


Fig. 1 (left) – Diagrammatic sketch of an axial-piston, variable-stroke, positive-displacement pump used in hydraulic transmission systems. The primary and secondary pumps are used for driving each sprocket, for steering, braking, as well as torque-speed range

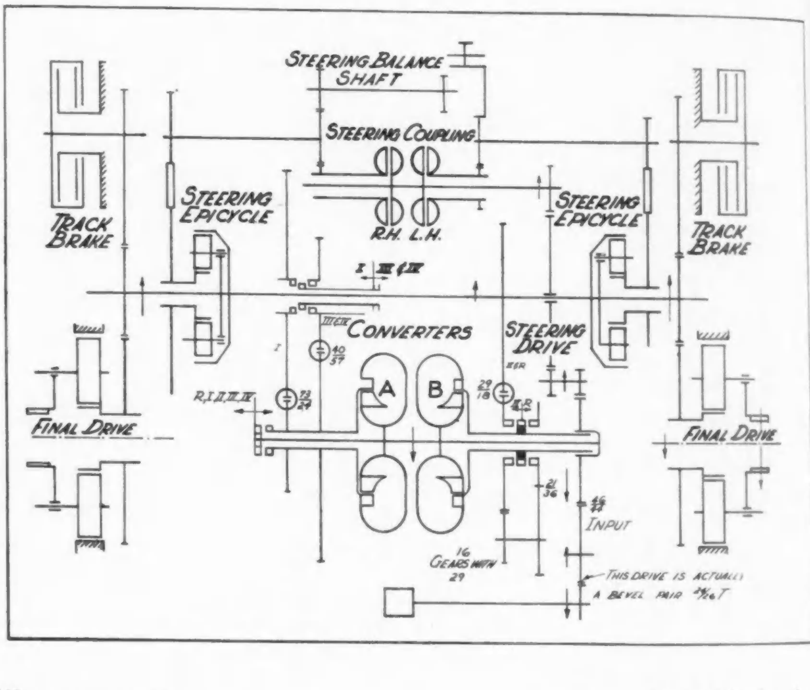


Fig. 2 (right) – Schematic diagram of a late automatic hydraulic transmission design

Fig. 3 (below) – A torque converter which can be operated as a fluid coupling

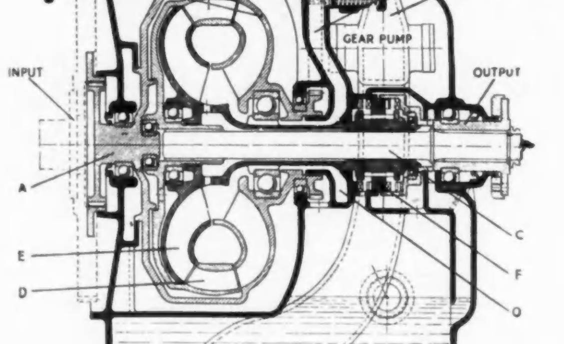


Fig. 4 (below) – General design of German universal joints which incorporated a novel plastic bearing race retainer

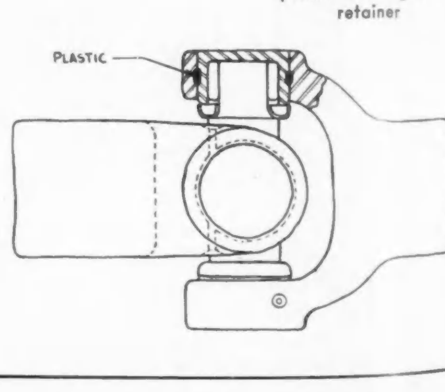


Fig. 5 – Self-energized disc type brake used for steering track-laying vehicles

was surprising to find German engineers having so little information on actual use and field results.

Gear boxes used in trucks and half-track vehicles were of conventional design, but full-track vehicles enjoyed unusual features to improve maneuverability and ease of handling.

The Tiger tank transmission had eight forward speeds and four reverse speeds obtained by compounding the gear trains. The geared steering differential provides two turning radii in each transmission speed. The turning radii vary with transmission gear ratio. A minimum turning radius of 7 ft is obtained in first speed and a maximum radius of 374 ft in eighth speed. With transmission in neutral, one track can be reversed and the other track driven forward.

New tank designs favored automatic hydraulic transmission systems. This was no doubt influenced by the capture of latest Allied equipment and the difficulty experienced in mechanical and electrical transmissions for high horsepower vehicles.

The axial-piston, variable-stroke, positive-displacement pump illustrated in Fig. 1 has a primary and secondary pump used for driving each sprocket, for steering, and braking as well as torque-speed range. Steering is controlled by separate oil operation from auxiliary fluid pump pressure. The left and right secondary pumps are interconnected during steering so that an increased angle on one side results in a corresponding decrease on the other side. Braking is obtained by retarding the primary pumps and sudden braking may be made by reversing the primary pumps. The normal pump pressures are claimed to be 2000 to 2200 psi with a maximum pressure of 6000 psi.

A late design of an automatic transmission for tanks is shown in Fig. 2. Twin stage stationary housing torque converters are used in combination with a four speed forward and reverse gear box. First and third speeds are driven through torque converter "A," and second speed and reverse through torque converter "B." Fourth speed is equivalent to direct drive and operates with both torque converters empty. The shift from one speed to another is made by emptying one torque converter and filling the other. Steering is accomplished by selectively filling either of two stationary case fluid couplings.

The torque converter, illustrated in Fig. 3, was used in a radio-controlled vehicle and is the single stage or reaction coupling type. This unit operates as a torque converter with the reaction member stationary until the impeller and turbine torque are equal. The reaction member is then locked to the turbine and the unit then operates as a fluid coupling. The reaction member control is automatic. The reaction member clutch gear is mounted on a helical spline and as the change from positive to negative reaction takes place, the clutch gear is shifted from engagement with the stationary case to engagement with the turbine. This combination allows a more efficient design of the single stage torque converter as it is not necessary to sacrifice desirable converter characteristics to obtain a suitable fluid coupling.

The general design of friction clutches used was conventional and very little development work was found. As a general observation, single plate clutches were used with engines up to 100 hp and two plate clutches were used with larger engines. The use of clutch brakes to aid in shifting the transmission gears was inconsistent. Some of the larger vehicles with sliding gears had no clutch brake, whereas some of the units with synchronized gear boxes, where a clutch brake is objectionable, used a clutch brake. Endless woven facings were normally used, but some thin molded facings cemented to steel surfaces were observed.

The general design of universal joints, as shown in Fig. 4, has a familiar appearance and the only novel feature is the method of retaining the bearing races in the yoke. Registering annular grooves are machined in both the yoke and bearing race and a thermosetting plastic forced into the opening at assembly. Accurate machining required in conventional design to maintain concentricity is eliminated as parts are assembled and maintained in the concentric position while inserting the plastic. It is claimed that a 3000-lb load is required to shear the plastic retainer in a medium size universal joint. A hand gun was used in the field for replacing the plastic ring.

Brakes were generally of conventional American or European prewar designs. An unusual self-energizing disc type brake, Fig. 5, was being used to steer track laying type vehicles. A manually controlled lever operates a wedge resulting in a relative rotation between the two discs. The rotation is transferred to axial movement by the balls rolling on the inclined guides, and the brake disc facings contact the friction surface of the rotating housing.

■

Varied Transmission Units Ingenious But Impractical

Digest of paper

by LT.-COL. EWEN McEWEN
British Ministry of Supply

(Paper entitled "Highlights of German Tank Transmission Design and Development")

WITH all the commendable features demonstrated in the unusually fine display of craftsmanship and ingenuity of design detail, German transmission designs were costly in man-hours and represented a highly complicated means of attaining the desired end, Col. McEwen reported.

In striving for effective tank transmissions, the Germans

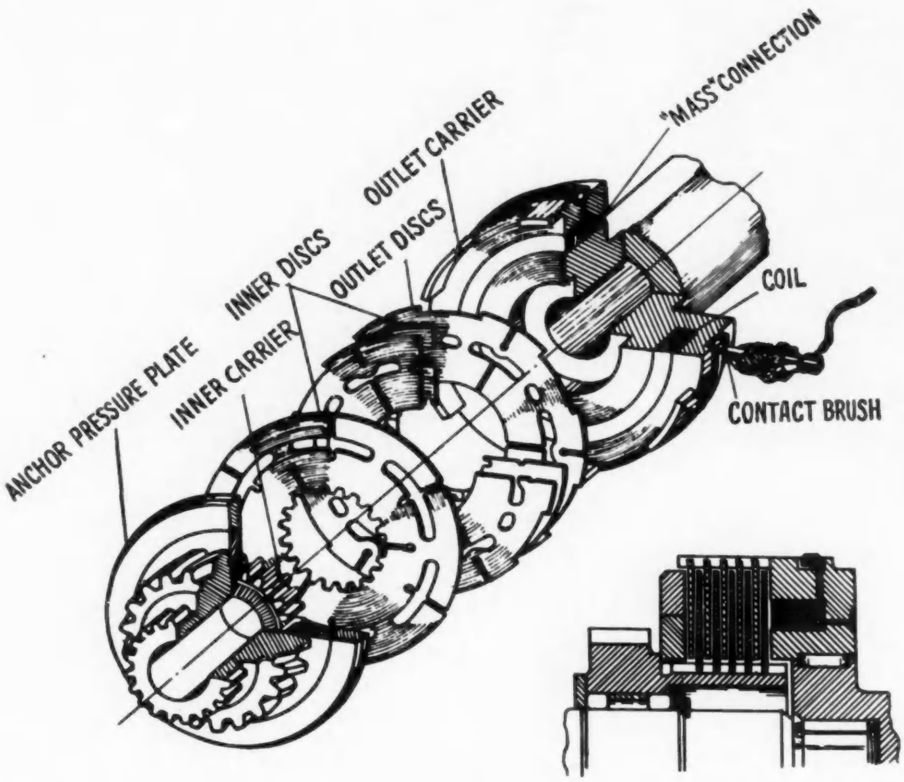


Fig. 1 – Electro-magnetic clutch assembly designed for the Panther tank which had a multiplate construction using steel laminations without friction linings

employed a wide variety of systems. Mechanical, hydraulic, and electrical transmissions were devised and extreme pains were taken to ensure proper synchronization and gear changing. The efforts to attain perfection were of no avail, for in most cases, he pointed out, the great degree of complexity prevented simple service operation, reduced service life, and made maintenance a nightmare.

The first wartime transmission described by the colonel, for the Pz.1 tank, had a five-speed forward and one reverse straight-forward crash gearbox of Aphon design. The Aphon principle was originally devised for quietness, although it was subsequently claimed to have a higher load carrying capacity than the orthodox shaft gearbox. Its characteristic feature is the direct mounting of each gear wheel in the gear case with a pair of bearings, the shafts passing through the gear bores being used purely for transmission of torque and transmission of bending stresses. The construction is costly in that a great deal of machine shop boring and numerous ball and roller races are required.

The Pz. III transmission, Col. McEwen related, utilized the synchronization principle of over-running inclined face dogs and provided various speeding up and slowing down devices. This system is controlled by a vacuum operated selector and gear engaging system while the synchronizing system and the main engine clutch are hydraulically operated. The transmission is preselective.

A total of 10 forward speeds is provided, the lower of which are also available in reverse at twice the reduction ratio. A separate direction lever is provided for engaging forward, neutral, and reverse. This 10-speed gear box consists of four sets of constant mesh helical gears and one set of constant mesh spur gears, mounted individually in line on roller bearings. The position of the dog clutches is changed by vacuum cylinders controlled by the distribution box and the master vacuum valve. The two synchronizing clutches which assist synchronization are controlled by an oil distribution box.

This highly ingenious and complex mechanism did not produce satisfactory results according to drivers interrogated, Col. McEwen revealed. With the 10 ratios all close together, the difference in performance of the vehicle in one gear from that of the next higher gear is so small that there is a tendency for the driver to skip intermediary gears and operate the unit as a five-speed gear box. Further, the closeness of ratios does not permit very rapid gear changes as is possible with an orthodox synchromesh gearbox.

■ First Conventional Conical Synchromesh

The Panther tank, he advised, incorporated the first example of a conventional conical synchromesh to be met in any German tank. The gearbox is seven-speed forward and one-speed reverse unit in which, following the usual German practice, the top gear is of little value and even sixth could only be expected to be used on the road. And again like all German designs, the Panther gearbox incorporates a large number of gears. The lubrication system is unnecessarily elaborate and includes a complex system of cast-in oil pipes in the gear casing itself. Uneconomical distribution of material in several of the gears was noted, leading to excessive bulk and weight, although the gearbox stresses were not high.

The Tiger tank gearbox is similar in principle to the 10-speed Pz. III transmission system and is an oil operated gearbox giving eight forward and four reverse ratios. The designers had gone to great lengths to ensure rapid gear changing, the author observed. A hydraulic accumulator is fitted in the oil system to provide sufficient pressure and

no less than five synchronizers are fitted in the gear box, one for accelerating and four for slowing down. The increased pressure overcomes the resistance of the selection valves. With all its intricacies, the Tiger gearbox had an unenviable reputation for unreliability, apparently due to failure of the hydraulic system and overheating.

Hydraulic transmission was considered after it was decided that satisfactory gear changing fôr a vehicle the size of the Tiger was not possible with mechanical transmission. In the hydraulic transmission system that was designed to overcome the shortcomings of mechanical transmission, a collector shaft from the engine ran forward to a combined forward and reverse steering gearbox which also incorporated an over-riding low gear. The main hydraulic transmission consisted of two torque converters which could be selectively filled.

First speed was obtained by filling one converter coupled to the output shaft through a 1.87 reduction and second speed was obtained by driving the collector shaft at an increase in speed from the output of the second torque converter. It was claimed by the designers that no trouble occurred with hydraulic transmission although the complicated clutch brake steering mechanism appeared to the colonel to be unsatisfactory.

The most interesting new development in German tank gearbox design was a unit employing electro-magnetic clutches, shown in Fig. 1, for changing gears in conjunction with single helical gears and a conventional layout. It was proposed to install this mechanism in the Panther, but only one unit was actually completed. The electric clutch is of multiplate construction using steel laminations without friction linings. In principle, it operated by leading the current to a ring coil embedded in the face of the magnet core from which magnetic forces passing through to compress the neighboring laminations, alternately connected to the inner and outer members. Difficulties were encountered with the soft iron magnet as it was not suitable in friction, and the embedding of the field cores in the magnet iron caused some grief as they did not readily remain in place with changes in acceleration and gearbox temperature.

In conclusion, Col. McEwen points out that the Germans religiously ground tank gearbox gears, exhibiting no knowledge of the potentialities of shot peening or the possibility of improving fatigue life by eliminating the grinding. The miscellany of transmission systems, which were largely inadequate and far from satisfactory, was due to a lack of a clearly defined policy by the Germans as to the trend of tank transmission design.

Suspensions & Steering Gear Dissimilar to American Types

Digest of paper

by R. L. WEIDER
White Motor Co.

(Paper entitled "Observations of Various German Suspensions and Steering Gear")

SUSPENSIONS and steering gears used by the German Wehrmacht, which differed from conventional systems common to American practice, were illustrated by Mr. Weider, based on his first-hand observation of various German, Austrian, and Czechoslovakian automotive industries.

The first suspension system he discussed, for the Bussing 4½ ton 4x2 type No. 500-S, consisted of semi-elliptic springs, front and rear, with the front springs anchored at the rear and using a slipper type shackle at the front end. The rear springs have conventional helpers incorporated but use slipper type shackles front and rear. Torque reaction is taken through the torque tube, around the propeller shaft, fastened to a crossmember through a ball joint. Radius rods fastened to the torque tube run to the rear axle housing.

The steering gear for this vehicle is of the worm and nut type. The steering movement of the steering wheel is transferred to the front axle by means of the steering column, the steering nut through the ball and socket joint to the pitman arm, to the drag link, and to the steering arm.

The second type of suspension system noted by the author, for the Bussing 4½ ton 4x4 type No. 500-A, differed from the previous system in that both ends of the semi-elliptic springs are mounted to the frame through slipper type joints. The torque reaction is absorbed in a torque tube fastened to No. 2 crossmember through a ball joint. The rear springs arrangement is the same as that previously described except that no radius rods are used on the torque tube and the ball joint of the torque tube is fastened to No. 4 crossmember.

The steering gear, also of the worm type, is slightly different from the 4x2 model in that the nut is geared to the cross shaft supporting the pitman arm rather than through the ball and socket arrangement, as described in

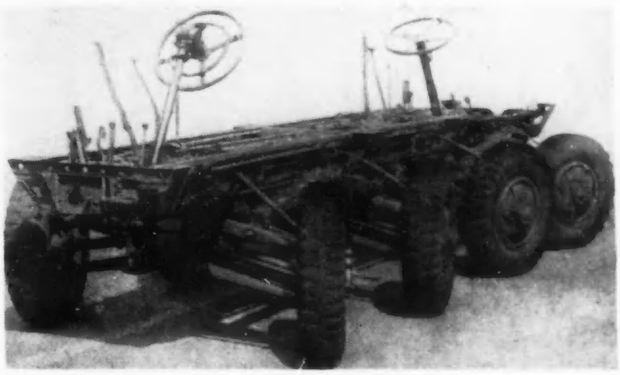


Fig. 1 – Chassis of the Bussing N. A. G. eight-wheeled armored car showing the full cramped steering

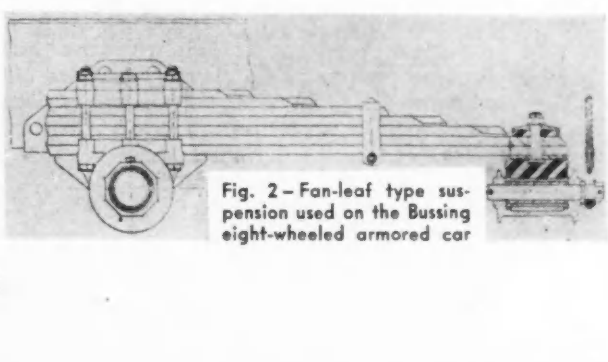


Fig. 2 – Fan-leaf type suspension used on the Bussing eight-wheeled armored car

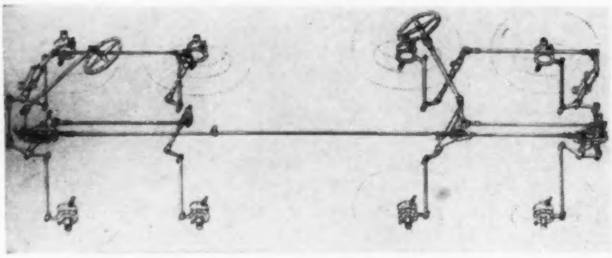


Fig. 3 – Complicated steering system of the eight-wheeled armored car enabled the vehicle to be conveniently driven at speed in either direction

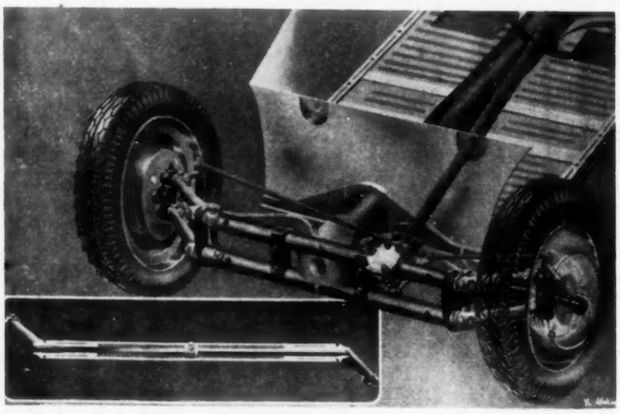


Fig. 4 – Front axle and gear mounting of the Volkswagen, the German jeep

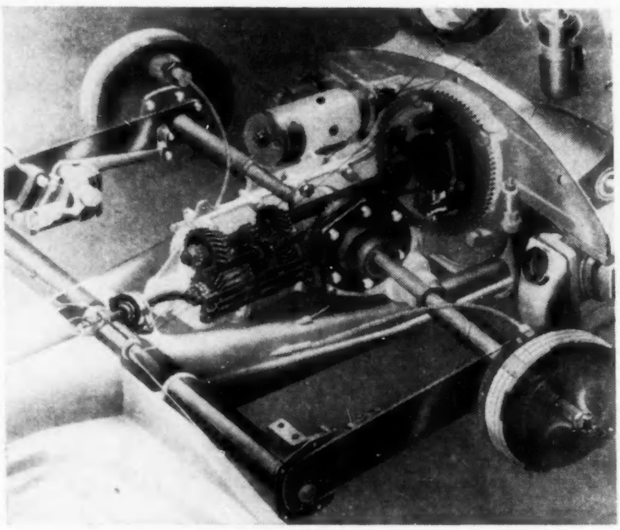


Fig. 5 – Rear axle assembly of the Volkswagen showing the two torsion bars splined at both ends

the previous gear. Both of the vehicles have a turning radius of 58.7 ft.

The third type of suspension Mr. Weider analyzed was one used in a four-wheeled armored car which had all wheels independently sprung. Each assembly consisted of two unequal length radius arms and two coil springs side by side. The springs operated between the lower arm and two brackets welded to the chassis frame. The radius arms were carried in "silent block" bushings at their inner ends, and on their outer ends there are cups to take the kingpin assemblies. Rebound is provided for by two stops on each suspension assembly. Each stop consists of a spindle attached by a swivel to the top radius arm, carrying two cups with rubber inserts operating through the suspension bracket. Two double-acting piston type shock absorbers are fitted to each unit.

This car can be either two-wheel or four-wheel steered. The steering wheel is inverted as in other German armored vehicles, eliminating the obstruction of the steering column in the driving compartment. The wheel is geared to the column by beveled gears, and provision is made for a turn indicator on the steering column.

The fourth suspension described was used in an eight-wheeled armored car which was unique in that it was built to steer by all eight wheels, either forward or backward. Fig. 1 shows the chassis with the full cramped steering. Each of the eight road wheels was linked to the frame by two swinging levers, one above and the other below the shaft, coupling the road wheel to its final drive gearbox.

The fan-leaf type suspension springs, shown in Fig. 2, were mounted outside and parallel to the frame side members. Each spring is pivoted to an extension of a cross tube of the frame, and the spring ends bear on the upper suspension levers through the intermediary of rubber blocks. These rubber blocks are bonded to the cast steel brackets which are pivotally attached to the suspension levers so that they can remain horizontal, whatever the inclination of the suspension levers. Their distortion also accommodates the lateral and transverse movement of the springs related to the levers.

Both upper and lower suspension levers are of I beam sections with the flanges vertical. The upper lever alone carries the bending moment due to the upward reaction of the wheel. The upward movement of the wheels is limited by rubber pads attached to suitable extensions of the final drive suspension bracket.

■ Vehicle Driven in Either Direction

The steering system of this vehicle, illustrated in Fig. 3, is extremely complicated owing to the provision of a steering wheel and column at each end of the chassis to enable the vehicle to be conveniently driven at speed in either direction. This system required coupling the two steering wheels together by 10 small bevel gears and a shaft running lengthwise along the side of the vehicle. The ratio of all bevel gears coupling the two steering column spindles with this long horizontal shaft was 1:1. The bevel gearing at the top of the front steering column had been adapted to give maximum convenience to the driver in the rather limited space available.

The last system discussed by Mr. Weider was that of the German jeep or Volkswagen. The torsion bars used in the front assembly, which can be seen in Fig. 4, were four flat steel strips welded together at the ends with provision for a locknut to limit twisting and side to side movement and to distribute the shock to each side of the suspension.

Fig. 5, illustrating the rear axle assembly, shows the two torsion bars splined at both ends. The bars are clamped at the center, and the splines at the outer ends are fitted into female fittings on the torque rod arms.

The steering gear, of the worm and sector type, differs from the conventional construction in that the steering worm shaft is short and an extension is used to connect the worm shaft to the steering wheel. The sector shaft is fitted with a socket in which the sector bearing is located. The sector bearing is designed to mesh with threads of the worm shaft.

Tank Tracks & Suspensions Found Soundly Engineered

Digest of paper

by TORE FRANZEN
Chrysler Corp.

(Paper entitled "Suspension and Track of German Track Laying Vehicles")

GERMAN development of track laying fighting equipment was initiated long before World War II in direct violation of the terms of the Versailles Treaty and carried on under the guise of farm tractor development. Mr. Franzen observed that the constant evidence of sound technical thinking shown in suspensions and tracks on most German vehicles was due to the able leadership of the man in charge of automotive research.

Mr. Franzen demonstrated the inherently good design characteristics of German track laying equipment by pointing out unique features in both operational equipment used in the war and designs still in the experimental stage.

Of the six operational tanks discussed, the PzKw I, Model B, shown in Fig. 1, was one of the earlier tanks with a suspension consisting of a leading wheel which is individually sprung and four following wheels suspended in two bogies. It is interesting to note that, like American tanks, the drive is on the front end in German construction. The track is the open type and guided on the outside of the track wheels. Individual track shoes are cast from a high manganese work-hardening alloy with case-hardened joining pins. Scarcity of manganese necessitated modification of the specification.

Individual springing of track wheels first made its appearance in the PzKw II, second of the German tanks developed prior to the war. The individual wheels are suspended from the wheel spindle mounted on an arm to which a cantilever leaf spring is mounted. The end of the cantilever engages a bracket mounted on the hull side.

German developments in heavier tanks were not halted by the work on lighter vehicles. The PzKw IV, illustrated in Fig. 2, is an 18 ton tank which first made its appearance in 1937. On this vehicle, there was a reversion back to bogie type wheel suspension with four bogies on a side, as can be seen in the illustration. Springing is secured by means of a cantilever spring bolted to the forward end of each leading bogie arm.

The Panther, shown in Fig. 3, introduced in the fall of 1942, was designed as a result of the German encounter with the Russian T-23. Originally designed to weigh 30 tons, a majority of these tanks were considerably heavier. It is on this tank that interlaced wheels first made their appearance on a fighting vehicle. The wheels are large enough to make track return rollers unnecessary. To gain the necessary flexibility without overstressing materials, two torsion bars are employed in this design. This construction was never quite successful as considerable bending took place near the anchorage of the torsion bars.

Fig. 1 – The German PzKw I, Model B tank, developed before the war, showing the one leading wheel and four following wheel suspension

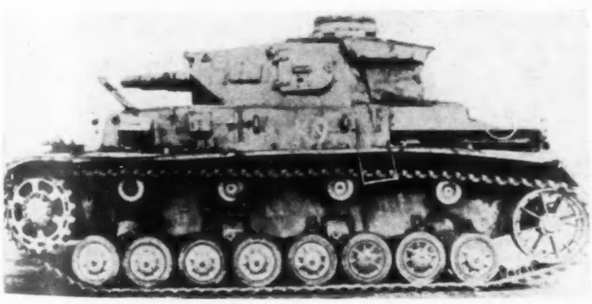


Fig. 2 – The PzKw IV tank weighed 18 tons and utilized the bogie wheel construction

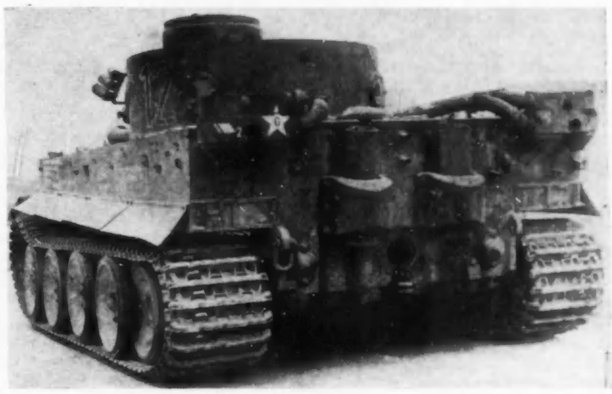


Fig. 3 – The 30 ton Panther tank was designed as a result of the German encounter with the Russian T-23

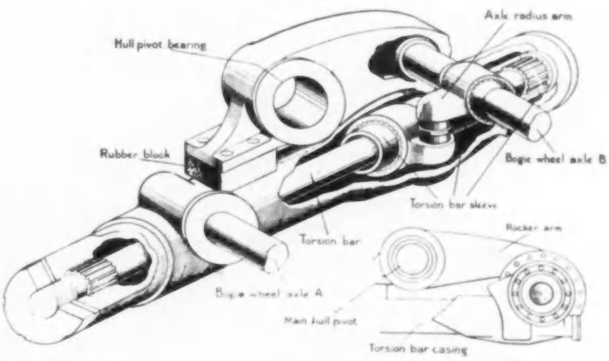


Fig. 4 – Bogie assembly originally intended for the Tiger I but later used on the Ferdinand heavy tank series

The Tiger I, originally designed to weigh 45 tons, actually weighed closer to 60 tons. One of the suspension designs for this tank deserves some mention, although it was discarded in favor of another arrangement and later used on a limited series of heavy tanks known as "Ferdinand." This design, shown in Fig. 4, calls for a bogie type structure in which the flexible member is a torsion rod which lies parallel to the longitudinal center of the tank. The primary bogie arm is rotably mounted on a pivot on the hull. The track is carried on a spring steel shoe without a roller.

Mr. Franzen drew attention to replacement of all rubber tired wheels with steel-rimmed resilient wheels on all German tanks, a scheme admittedly taken from the Russians. The advantages claimed for resilient wheels were longer life, carrying the load on all of the rubber instead of on a small contact area, cracking off of ice and packed snow, and the need for 50% less rubber for the same flexibility as compared with rubber tired wheels. Its disadvantages were the high noise level, need for redesign of the track, and the resultant greater unsprung weight.

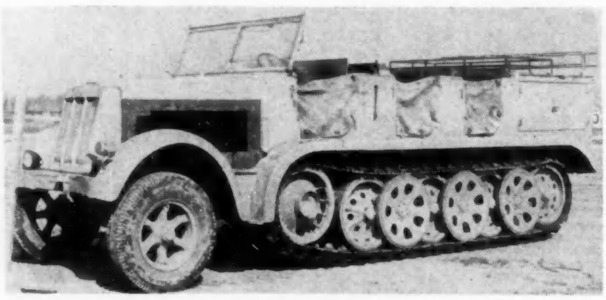


Fig. 5 – The half track, with a rated capacity of 8 tons, was an outgrowth of tractors developed for mechanization of German artillery

Fig. 6 – Small half track known as the Mountain Goat

The half track, Fig. 5, the author explained, was an outgrowth of tractors developed by the German Army for mechanization of its artillery. The wishbone type of radius rod extending from the spring purchase is almost a direct copy of the well-known Ford construction. Great care was taken in the design of these vehicles and many interesting features of detailed design were developed to give these tractors a long life with a minimum amount of service. The tractor shoes are made from clever steel castings. Instead of the crude dry pin joint used on all the fighting vehicles, there is a well designed needle bearing which is so carefully sealed that thousands of miles of usage show no appreciable signs of bearing wear.

A small tractor developed, known as the "Mountain Goat," Fig. 6, utilized a single motor cycle type wheel in place of the conventional automobile front wheel steering. Only four track wheels were used on each side, but this machine was essentially the half-track type of vehicle.

A radical vehicle developed was the monster 200 ton tank known as "The Maus," Fig. 7, of which only two were actually completed although material was available for a large series. It is suspended on six double bogies on each side and has a track 42 in. wide. Each double bogie unit, mounted between an outer armor and the hull itself, consists of primary and secondary arms. The primary arm is mounted on a shaft extended from a beam connection hull and outer armor. The secondary arm is pivoted on the leading wheel spindle.

German General Staff plans called for replacement of the abovementioned vehicles with three tractors designing a slow and fast vehicle in each model. It was planned that the fast vehicle track be equipped with needle bearings and roller type sprocket arrangement and that the slower vehicles be provided with a dry pin track and double sprocket. Other design requirements anticipated were deeper and stiffer frames of all welded construction, independent torsion bar front suspension, change in needle bearing design, and welded instead of cast shoe construction for needle bearing track. Research on flotation and traction was under way at the close of the war as the Germans had not made any scientific study of soil dynamics prior to the war and this was reflected in short life and unsatisfactory performance of various parts such as track pads.

The shock absorbers used on the heavy tanks were well designed and well made but fell short in their function as the proper technique of damping the compression stroke was never attained. A fully satisfactory shock seal and a really efficient fluid were never developed.

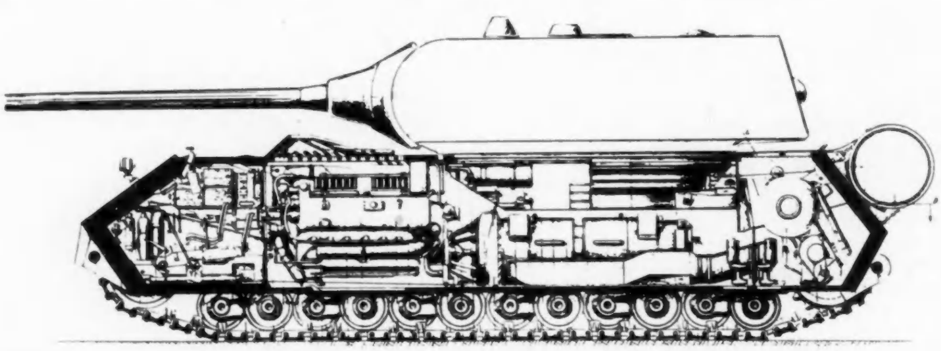


Fig. 7 – The Maus 200 ton monster tank, of which only two were completed

Metal Shortage Prime Factor in Poor Radiators & Coolers

Digest of paper

by F. M. YOUNG
Young Radiator Co.

(Paper entitled "German Radiators and Oil Cooler Structures and Facilities for Manufacture")

GERMAN radiators and coolers were generally inferior to American products largely because of shortages in materials such as copper, brass, and tin-lead solder, Mr. Young noted, although several manufacturing techniques developed were unique.

One of the difficulties encountered by the Germans was the protection of aircraft aluminum cooling units from corrosion. One method for prevention of corrosion consisted of dipping the radiator tubes and fins into a lacquer bath containing finely ground particles of aluminum. The granular aluminum was to assist in heat transfer as lacquer itself is an insulator rather than a conductor. The life of such a unit, however, was greatly limited and the heat transfer rates low and unsatisfactory.

Ground vehicle radiators invariably consisted of steel or brass tubes and steel fins. The radiator core structure was dipped in 8-92 or 20-80 tin-lead solder for both corrosion protection and because of rapid oxidation of steel during processing. A track layer radiator was so heavy, the author demonstrated, that two men could barely lift it. These totally dipped radiators which were, in effect, a rigid mass, were very strong but not nearly as efficient as the conventional structure used in this country.

One radiator type, he described, had zinc elements because of the unavailability of copper and brass. An ingenious machine was devised which scarfed a fin from coil zinc stock being fed through the machine and also cut the zinc in part from the body of the material and set it up at 90 deg extending outward from the fin.

LÄNGERER AND REICH KÜHLERFABRIK (Germany)
ZINC RADIATOR
COMPARISON OF PHYSICAL CHARACTERISTICS

	GERMAN ZINC RADIATOR	YOUNG AX-92
Tube & Fin Bond	Integral	Oven-Bake
Tube Material	Zinc	Brass
Fin Material	Zinc	Copper
Tube Wall Thickness In.	0.014 to 0.028	0.0063
Fin Thickness- In.	Tapered 0.1 to 0.014	0.0035
Tube Spacing- In.	3/8	5/8
Core Thickness- In.	1-49/64	1-13/16
Fin Spacing- In.	8.7	9
Weight Lbs Per Sq Ft. Frontal Area	10.65	4.58
Volume of Metal-Cu In-Per Sq Ft Frontal Area	41.2	14.43

THERMAL CONDUCTIVITY (212°F)

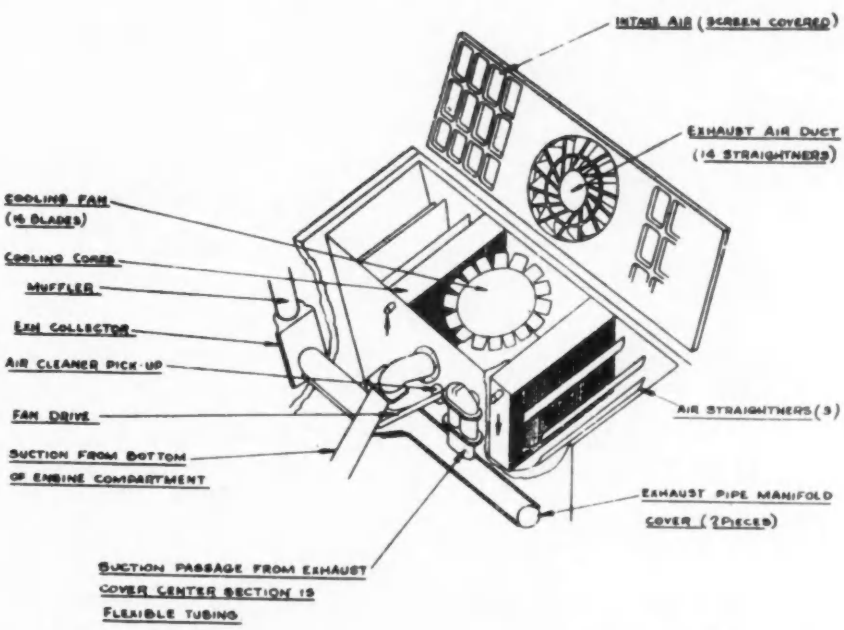
COPPER	218 Btu/Hr/Sq Ft/°F/Ft.	
ALUMINUM	119	55% of COPPER
ZINC	64	29%
BRASS	60	28%
MILD STEEL	26	12%

Fig. 1 – Comparison of physical characteristics of a German zinc radiator and an American copper and brass radiator of similar size which indicates that the zinc unit is 132% heavier than the copper and brass product

■ German and American Radiators Compared

Using these zinc elements, a core was prepared and tested in the United States which, under identical air and water flow conditions, the author indicated, was 15%

Fig. 2 – Each compartment of the Panther tank oil cooling system contains a 16 in. diameter axial flow fan of the suction type which moves the air upward. The shuttered air straighteners improve and control air flow and assist in warmup and maintenance of proper temperature during cold weather



lower in heat transfer capacity than an American radiator of similar size. Fig. 1, which compares the physical dimensions and material specifications of the German zinc radiator and an American copper and brass radiator, reveals that the zinc radiator is 132% heavier than the brass and copper unit.

Oil cooler casings were made of steel in the latter part of the war due to a shortage of copper and as a result, Mr. Young pointed out, the units became heavier and corrosion and oxidation occurred during fabrication. Large circular units were used and a heavy stiff steel ring later added to prevent breakage encountered from vibration, expansion, and contraction.

The cooling system of the Panther tank consisted of 4 radiators, 2 on each side of the tank hull besides the engine compartment. This feature guards the radiator cores from exposure to engine fumes, oil, and other foreign matter. The right forward radiator is partially utilized for cooling of transmission oil and the other units solely for engine jacket coolant flow.

Each compartment, as shown in Fig. 2, contains a 16 in. diameter axial flow fan. The fan is a suction type and the air moves upward. Air enters the cooling compartment at each end and passes through the radiator before it is taken into the fan. Air straighteners with shutters are built in to improve and control air flow which assists warmup and maintenance of proper temperatures during cold weather. The system is equipped with a pressure relief valve set at 5 psi.

In evaluating the tank cooling system design, it is apparent to the author that the cooling systems were well balanced because of the excellent attention given by the German engineers to handling of air. The coolers were limited in the range of temperatures and to low pressures in operation compared to American coolers which operated satisfactorily between —40 F and 125 F and pressures in excess of 80 psi.

The use of atomic hydrogen arc welding for assembly of aluminum aircraft radiators, he felt, was developed to a high degree and was used throughout the industry in a standard manner and pattern both as to method and procedure in accomplishing a total unit. This is in contrast to the general limitation of the process to ferrous metal welding in this country. The art was developed to the stage where atomic hydrogen welding was standardized in its every detail in the several plants where the standard product was being fabricated on a production basis.

■

German Tire Progress Curbed by Industry-Army Reticence

Digest of paper

by EARL W. GLEN
Civilian Production Administration

(Paper entitled "Observations of the German Rubber Industry")

INFERIORITY of German tires to American tires was largely due to a lack of cooperation among the manufacturers and the armed forces, Mr. Glen contended. In spite of its early pioneering work on synthetic rubber development, German rubber industry production was far below that of this country.

The many advanced developments observed in both production equipment and experimental devices were more than offset by the difficulties created in their Teutonic type of organization which was notorious for its lack of joint participation and mutual exchange of technical developments.

One type of process – brass plating of metal goods to facilitate bonding of synthetics to track blocks and bogie rollers – was excellent compared to the other conventional methods of producing rubber goods.

■ Cellular Filler Replaced Inner Tube

An interesting product described by the author, the Luka Reifen, was a tire unit which performed the same function as the American run-flat tire construction and incorporated a cellular solid rubber filler to replace the inner tube. When placed inside of a regular truck tire, this unit was slightly in compression and was claimed to operate successfully without air. Its principal merit was that its manufacture was completely independent of the tire in which it was used which permitted maintenance of production without the handicaps involved in production of the American run-flat construction. The Luka Reifen was also desirable for its simplicity of fabrication.

Another interesting product, the Draftband Reifen, incorporated a demountable feature accomplished by building the tire without a steel band and using a bead wire embedded in a beveled hard rubber base as the surface to mount on a beveled split rim. The principal advantages of this type unit were simplification of shipping through elongation of the tire and elimination of the steel base band weight, and the ability to dismount and change tires in the field.

■ Experimental Production Unusual

More fascinating than the tire production plants, Mr. Glen felt, were the experimental laboratories of the I. G. Farbenindustrie Synthetic Rubber Laboratory. An experimental building unit included machines for producing tires all the way from passenger size to large truck tires. Features of particular interest in this tire production unit were the special individually powered rollers on mills and calenders to facilitate power consumption studies on different types of synthetic rubbers. Studies conducted in a controlled atmosphere room eliminated synthetic tire production difficulties by demonstrating the temperature and humidity below which tackiness and welding properties could be reduced in the tire building process. The author was of the opinion that this concerted effort toward the improvement of synthetics and tire building techniques was unexcelled even in the United States.

The lack of cooperation in tire production stemmed, on the one hand, from the jealousy of I. G. Farben in guarding its prerogatives on creation and development of Buna type synthetic rubbers. On the other hand, the German Army rarely, if ever, provided industry with samples of tires from operational vehicles with the result that the rubber industry was operating blindly. It is not strange, Mr. Glen explained, that the engineers in industry were well satisfied with their wartime Buna S type tire when as a matter of fact the tires left a great deal to be desired.

One of the shortcomings found in German tires, he

revealed, was the rayon tire cord which compares with the material in use 15 years ago in this country. Road tests conducted in the United States on German tires revealed failure at low mileage from separation, circumferential shoulder, fatigue, and severe tread cracking. In a 30% overload test, no German tire ran more than 4000 miles which was considerably below the average for American synthetic tires.

Even if the Germans had improved tire design and rayon tire cord fabric to make their tires more serviceable, Mr. Glen summarized, they still would have had to contend with the difficult production bottleneck in milling.

■

German Crude Oil Shortage Stimulated Coal Synthetics

Digest of paper

by MAJOR N. L. KLEIN
U. S. Army Ordnance

(Paper entitled "German Military Fuels and Lubricants")

SHORTAGE of crude petroleum was instrumental in compelling the Germans to devote their technical efforts to the utilization of other natural resources for acquisition of military fuels and lubricants, Major Klein divulged in describing the wartime types of aviation, motor, and diesel fuels and lubricants.

German wartime oil economy was built around production of fuels and lubricants from coal using the following basic processes: hydrogenation, Fischer Tropsch synthesis, and coal carbonization and gasification.

Approximately 85% of high octane aviation fuels was made by hydrogenation of coal and coal tars. Hydro naphthas produced in the process were dehydrogenated under pressure using a special catalyst to produce a stable, rich performance rating aviation fuel.

The Fischer Tropsch process involves the synthesis of hydrogen and carbon monoxide and produced gases, gasoline, diesel fuel, and high melting point waxes which amounted to less than 10% of the overall oil supply.

Coal carbonization, the author noted, supplemented the inadequate supply of natural gases. In the gasification process, the carbonized residue was reacted in a fine state of subdivision with steam and oxygen to produce carbon monoxide, carbon dioxide, hydrogen, and methane.

Three grades of aviation gasoline designated A3, B4, and C3 were used by the German Air Force. The A3 fuel was used for training purposes and had an octane rating of 80. The addition of 30% by volume of alcohol to obtain the required octane rating without benzol or lead, which became scarce, was permitted. The 89 octane B4 fuel was used mainly for bombers and fighters. The C3 grade was a highly aromatic fuel with an octane number of 95 that had a high rich performance rating.

Motor fuels used by the German Army had a specified octane number of 72 and were blended from straight run, cracked, and Fischer Tropsch gasolines with and without the addition of lead and benzol. During the Russian campaign, a shortage of automotive fuels necessitated the use of aviation B4 gasoline in tank engines. With no satisfactory method of field deleading of gasoline, tank engines, which were not built with chrome or stellite-faced exhaust valves as were aviation engines, could not run more than 1260 miles on B4 gasoline.

■ Coal Hydrogenation Gave Diesel Fuels

Automotive type diesels, the author observed, operated satisfactorily on 40 cetane number fuels obtained from the hydrogenation of brown coal. When a scarcity of diesel oil occurred, brown coal tar and the pre-hydrogenation product of brown coal were blended with gasoline and used as diesel fuel.

Two grades of lubricating oils were used by the German Air Force. The S-3 type, the preferred grade, consisted of a mineral oil solvent and a synthetic bright stock and was produced by the condensation of paraffins, ethylene polymerization, and to a small degree propylene polymerization. The V-2 type was a compounded oil containing an electrically thickened seed oil. For cold starting, aviation oils were diluted with gasoline up to 25%, depending upon the ambient temperature. Oil foaming in aircraft engines was solved by installing oil centrifuges which, by increasing the oil pressure, forced the foam forming gases into solution.

Engine oil for ground force equipment was supplied in both winter and summer grades, the major revealed, and were blends of conventionally refined mineral oils and synthetic bright stocks. Approximately 3% fatty oil was added for use in tanks. Oil filters were used with the fabric-tube type predominating. Drain periods for gasoline engines were usually set between 2500-3000 miles and for diesel engines between 1500-2000 miles.

It is obvious from the number and scope of the programs, the author concluded, that particular emphasis was placed upon the determination of engine-fuel relationships and the development of test equipment and procedures to rate fuels and lubricants in terms of service performance.

■

Autobahn System Paved Way for Automotive Advancement

Digest of paper

by JOHN W. WHEELER
Burlington Lines

(Paper entitled "German Autobahn—Its Relation to German Industrial Economy and Traffic System Used")

THE Autobahn stimulated the entire German automotive industry and stands as an engineering feat that more than measures up to modern road-building standards, Mr. Wheeler reported.

In order to discuss intelligently the merits and value of the Autobahn to both German prewar economy and wartime effort, he considered the following phases of its development:

1. Conception, organization, and construction,
2. Use prior to the war,
3. Use in war,
4. Present condition.

The Autobahn network was conceived by the new National Socialist state in 1933 which enacted legislation to

place highway control under one central organization to eliminate lack of maintenance control and technical standards. The major portion of the construction was carried on by Organization Todt, a regimented group of contractors and road workers.

■ Soil Mechanics Reflected in Design

In design and construction of the Autobahn, full use was made of the then present knowledge of soil mechanics. Controlling grades and curves are quite similar to American standards. Both the subgrade and the surface slab were unusually well-constructed, Mr. Wheeler demonstrated, for cracking showed up to be a minimum and scaling was seldom if ever encountered. Curing was done slowly and meticulously.

The use of the Autobahn prior to the war was not as great as the use of our modern roads because there was a limited number of motor vehicles. However, buses and trucks used the highway to good advantage. Not only did the Autobahn stimulate the motor industry and motor traffic, but it also contributed decisively to fighting unemployment during its construction at a time when one third of all Germans capable of working were unemployed.

During the war, all forms of transport were completely taken over by the Reich. Motor fuel was conserved for the armed forces and little use was made of the Autobahn except by the troops and supporting industries. As motor fuel became scarce, motor cars were transformed to wood burners.

The Autobahn was damaged little during the war aside from its bridge structures, the author noted. The Germans demonstrated stupidity in destroying the fine bridges of the network in their retreat. Whereas destruction of one span would have rendered a bridge completely useless to the Allies, the Germans demolished the entire structure in most cases. The roads themselves were not damaged to any extent; however, railway lines were almost completely destroyed.

Transportation as a whole was ruined, the author felt, and decades will elapse before it equals the once efficient system which existed.

■

Roumanian, Austrian Wells Major Nazi Crude Source

Digest of paper

by MAJOR LAWRENCE J. GRUNDER
U. S. Army Ordnance

(Paper entitled "War Developments of the Oil Industry in Austria and Roumania")

AUSTRIAN and Roumanian oil industries, which provided most of Germany's crude oil requirements, were equipped with difficult-to-bomb production facilities, Major Grunder related. Production of all oil products within Germany indicated, however, that those derived from coal overshadowed those derived from oil by a ratio of greater than 3 to 1.

Roumania, whose crude production in 1943 was five times the maximum annual production of Austria, showed a continued drop in crude production from 8,703,000 tons in 1936 to 5,266,000 tons in 1943, even though maximum efforts were employed during the war to increase the output. Over 80% of Roumanian crude is paraffinous or semi-paraffinous, and of the non-paraffinous balance only half is suitable for making aviation base fuel. There was an under-capacity in cracking facilities although surplus capacity existed in straight-run distillation units. Less than 25% of crude refined in Roumania in 1943 was cracked due to the cracking facilities shortage.

A network of private pipelines connected the oil fields and encircled Ploesti, permitting movement of crude and refined products east to the Black Sea and south to the Danube. A 33-mile long, 12 in., natural gas pipeline was built from Manesti to Bucharest carrying 75,000 cu m per hr.

Austrian crude oil producing areas northeast of Vienna produced only 50,000 tons in 1938, but added 250,000 tons per year over the period of the next four years. Over 95% of the crude is paraffinic, yielding from 0.5% to 13% of about 60 octane gasoline. Lack of cracking facilities in the refineries on the outskirts of Vienna, which was intentional when built prior to the war to avoid high tax rates, proved disastrous toward the end of the war.

Heavy Allied air raids drove the Germans to the development of a plan for constructing small refining units at locations difficult to bomb from the air and which would receive crude oil by barge, rail, or truck from nearby sources. Of general interest, the major pointed out, was the layout of one such refinery built in the tunnels of a mountain in upper Austria. The boiler plant was located in a separate tunnel. Two high pressure locomotive boilers were mounted on brick furnace bases. Forced draft was employed and an uncamouflaged iron chimney projected through the offset entrance tunnel and upward.

A room in one of the tunnels contained four insulated fractionating columns grouped together, with the instruments so positioned as to allow one workman to see all the indicating thermometers and gages. The room was ventilated by electrically-driven equipment located just beyond the tunnel offset and, the major observed, no leaks and very little odor were evident.

■ Subterranean Facility Well Equipped

In the several tunnels was found an endless series of shops, electrical control rooms, and tankage on both the floor level and the upper deck. This facility was adapted to discharge or fill 20 tank cars at one time. Steam equipment was available to permit handling of heavy products in cold weather. Other tunnels in various stages of completion were to have housed oil treating and clay contacting plants, machine shops, laboratories, warehouses, and underground loading and unloading facilities.

Natural gas output increased with the rise in crude oil production, the author disclosed. Gas was used in the oil fields and refineries for production of gasoline, gas lift, and gaseous fuel and also provided a source of heat for industry and homes.

Crude oil now available in Germany, Austria, Hungary, and Roumania, the major summed up, is adequate to satisfy peacetime demands of those and several other southern European countries. The refining processes are antiquated, however, and not suited to a peacetime market for higher grade fuels and lubricants.

SAE Coming Events

Meeting	Date	City	Hotel
• Summer (Semi-Annual)	June 2-7	French Lick, Ind.	French Lick Springs
• West Coast Transportation & Maintenance	Aug. 22-24	Seattle	New Washington
• Tractor	Sept. 11-12	Milwaukee	Hotel Schroeder
• Aeronautic Meeting and Aircraft Engineering Display	Oct. 3-5	Los Angeles	The Biltmore
• Transportation & Maintenance	Oct. 16-17	Chicago	Knickerbocker
• Fuels & Lubricants	Nov. 7-8	Tulsa	Mayo
• Air Transport Engineering	Dec. 2-4	Chicago	Edgewater Beach

Cincinnati – June 13

Columbia Station Club House; dinner 6:30 p.m. Trip through the Cincinnati Gas & Electric Co. Columbia Power Station.

Cleveland – June 21

Hawthorne Valley Country Club; SAE Outing and Golf Party. Golf begins 12 noon. Banquet – 7:00 p.m.

Detroit – June 28

Forest Lake Country Club; Ladies Night.

Hawaii – June 17

Pacific Club, Honolulu; dinner 7:00 p.m. Closed Meeting. Motion Pictures.

Metropolitan – June 13

Pennsylvania Hotel, New York; meeting 7:45 p.m. Possibilities of Rockets, Ram Jets and Pulse Jets – M. L. Lawrence, president, Reaction Motors Inc.

Milwaukee – June 14

Merrill Hills Country Club, Waukesha; dinner 7:00 p.m. Ladies Night. Dinner and Dance.

Northern California – June 11

Enterprise Engine and Foundry Co., San Francisco; buffet supper 6:00 p.m. Early Engineering in Bay Area – Charles A. Winslow, president, Winslow Engineering Co.

Southern California – June 14

Biltmore Hotel, Los Angeles; meeting 8:00 p.m. Fuels and Lubricants Meeting. Experience in the European War Theater – Lt.-Col. L. J. Grunder. Fuels and Lubricants Situation in the South Pacific Theater – Capt. P. B. Lohmann, USN. Experience with Fuels and Lubricants in Maintenance – Col. L. L. Beardslee.

Western Michigan – June 20

Hackley Art Gallery, Muskegon; Streamlined Trains – Dr. Michael Watter, Edward G. Budd Co.

Williamsport Group – June 11

Lock Haven Country Club; dinner 6:45 p.m. Light Variable Pitch Aircraft Propellers – John D. Waugh, public relations, Koppers Co., Inc.

Dickinson Appointed SAE Paris Delegate

CHOSEN as official representative of the SAE at the Sixth International Congress for Applied Mechanics, to be held from Sept. 22 to 29 at the Sorbonne, Paris, was SAE past-president Dr. H. C. Dickinson, formerly with the National Bureau of Standards. Selected as alternate was Dr. S. J. Zand, Sperry Gyroscope Co., Inc.

Dr. J. C. Hunsaker, chairman of the National Advisory Committee for Aeronautics, and Prof. Theodore von Karmen, California Institute of Technology, compose the secretariat for the United States.

Subjects for discussion at the proposed Congress will include:

I. Structures, Elasticity, Plasticity;

II. Hydro- and Aerodynamics, Hydraulics;

III. Solid Dynamics, Vibration and Sound, Friction and Lubrication, and,

IV. Thermodynamics, Heat Transfer, Combustion, and Fundamentals of Nuclear Energy.

The address of Henri Roy, the secretary general of the Congress, is Institute Henri-Poincaire, 11 Rue Pierre-Curie, Paris (Ve).

Improved Ignition

cont. from p. 19

tively fire the charge regardless of the engine power rating. One method suggested, by means of chemicals, is to be further investigated. Another possibility is the glow plug, similar to the semi-diesel plug. An interesting phenomenon with regard to glow plugs, revealed at a recent meeting, is that ignition of aviation gasoline is dependent upon the quantity of heat applied rather than the temperature.

A third proposal for firing otto-cycle engine charge is by electronic means; the spark would be produced by using the piston and cylinder head as electrodes. An immediate problem visualized for this system is severe timing difficulties. Wave guide distribution using di-pole gaps has already been pursued by several radio companies who are now developing radar spark plugs.

The second problem, design of suitable ignition cable, is occasioned by increased temperature difficulties in the newer piston-type and turbine engines in which there is a possibility of developing temperatures of 350 F at the cable end. Because of this high temperature, trouble is anticipated with the copper conductor and aircraft engine manufacturers are looking to ignition cable suppliers for the development of suitable cable. Advanced as a solution is the molding of silicone to that end of the cable in the high temperature zone.

Spark-Plug Sticking Probed

Spark-plug sticking or thread seizure, the third problem being considered by the Committee, is a troublesome maintenance problem to aircraft operators, especially airlines. A total of 49 questionnaires were circulated among spark-plug and engine manufacturers, airline operators, the AAF, and the National Advisory Committee for Aeronautics to determine the prevalence of aircraft spark-plug sticking in reciprocating engines. The recipients were asked to prescribe recommended remedies to minimize sticking.

Questionnaire replies have been received and analyzed by a subcommittee consisting of G. M. Paulson, B. G. Corp., Chairman; E. P. Kovac, American Airlines, Inc., and J. K. Rudd, Wright Aeronautical Corp. Analysis of the survey replies by the subcommittee revealed that:

- Spark-plug sticking is common to all types of air-cooled engines because of their higher operating temperatures;
- Condition of the plug and cylinder bushing threads is an important factor in minimizing sticking. The use of stainless steel bushings greatly reduces sticking;
- There is no conclusive evidence that, beyond the first installation, plating has any effect on sticking;
- None of the present thread lubricants will eliminate sticking, although indications are that graphite, mica, and zinc oxide lubricants may reduce sticking.

Recommendations based on the above revelations are being prepared by the subcommittee for submission to the Ignition Research Committee at its next meeting. The Committee is considering issuing the spark-plug sticking report as an Aeronautical Information Report.

The spark-plug terminal feature needing

improvement is the connection, since time consumed disconnecting terminals in present-day, multi-row engines is excessive. Various types of quick disconnectors are being experimented with by several manufacturers. Care must be taken in quick disconnector design to prevent electrical leakage causing radio interference, especially at high altitudes.

Ignition Analyzer Analyzed

Development of an ignition analyzer, the last phase of the Committee's program, is instigated by the desire to provide the mechanic with a visual indication of ignition trouble that can be easily interpreted. Oscillograph analyzer types have given fairly good test results, but present difficulties in pattern interpretation. Chairman A. L. Beall, Wright Aeronautical Corp., has stressed the importance of quickly locating the trouble in the ignition system with the analyzer, if it is to serve any useful function. Further discussion of the problem will be held after test results of several experimental analyzers are reported to the Committee.

Helicopter Research Referred to NACA

PRESENTATION to the National Advisory Committee for Aeronautics of a consolidated report covering recommended helicopter research items and review of new projects requiring early consideration was embodied in recent action taken by Committee S-2, Helicopters, of the SAE Special Aircraft Products Subdivision.

The Committee reviewed, of its own volition, areas of helicopter engineering needing further research and laboratory testing and developed a recommendation to the NACA covering projects not within scope of the Committee. Among the research items decided to be outside the Committee's scope – and so reported to NACA are:

- Study of aerodynamic and structural characteristics of rotors to obtain a complete bending moment and centrifugal tension survey,
- Flight or wind tunnel tests to determine influence of blade flapping on maximum speed, and the relationship between blade tip stall, tip speed ratio, and mean blade angle of attack,
- Determination of the character of the down-wash and span-wise lift distribution of a rotor in horizontal flight at various speeds and tip speed ratios,
- Investigation of the aerodynamic effect of tab type blade controls, considering the disproportionate velocities on the advancing and retreating sides of the rotor.

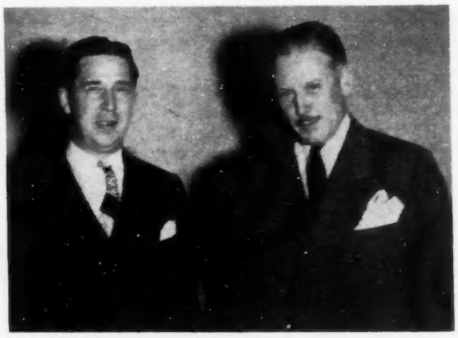
In view of the volume of work being handled by the NACA, the Committee agreed to undertake a number of projects worthy of early consideration which are within scope of its activities. Chairman R. H. Prewitt, Kellett Aircraft Corp., stated in clarifying the extent of the new task that, "the main objective of the new projects is not to undertake considerable test work, but to consolidate all available data pertinent to each problem in report form for the Committee's review and consideration."

Among the new projects are:

1. Landing gears,
2. Performance correlation,

Rambling Throug

SUCCESSOR of Exercises Lemming and Polar Bear, Exercise Muskox was a Canadian Army motorized trek of 3100 miles reaching well within the Arctic Circle. Col. J. T. Wilson, who was instrumental in organizing these Exercises, told **CANADIAN SECTION** on March 20 that purposes of Exercise Muskox have been the quest of Arctic data and radio propagation; effect of the Aurora Borealis on ionospheric layers; terrestrial magnetism; geology, glaciology; botany and human physiology under protracted exposure to extreme sub zero temperatures and persistent, often high winds. Failure of much equipment under low temperature conditions indicates the need for large scale improvements in winterizing technique, he said, and it is expected that the expedition will lead to important advances in the art.



SAE Vice-President E. N. Hatch, who is also Metropolitan Section vice-chairman for T&M, with Robert Cass, White Motor Co., speaker at the Section's April 11 meeting

More than 350 members and guests heard Robert Cass, assistant to the president, White Motor Co., Cleveland, discuss "Engine Requirements for Future Trucks and Buses" at the **METROPOLITAN SECTION** meeting April 11. The meeting was under the chairmanship of E. N. Hatch, New York Board of Transportation, SAE vice-president and vice-chairman of the Section. Mr. Cass, a few of his friends, and several members of the Section's governing board were guests of R. E. "Jerry" Tobin, chairman of the *Accelerator* advertising committee, for an informal supper preceding the meeting, which was held in Pennsylvania Hotel.

Earl Gulick, general manager of the Tire Mfg. Division of B. F. Goodrich Co., started the all-day 17th anniversary meeting of the **PITTSBURGH SECTION** by discussing "Just How Good is Man-Made Rubber When Used in Tires?" Discussers debated comparative skid resistance of synthetic and natural rubber tires, talked about balancing synthetic rubber and admitted the wartime difficulty of maintaining prewar standards.

At the afternoon session, R. L. Paulson, Research Department, Service Section of General Motors Corp., presented a paper on postwar planning for "Dealer and Fleet Service Plants," and reported, in reply to a question, a trend toward more comprehensive service by dealers; and E. D. McKean, Allegheny County Motor Co., presented a paper prepared by the Oldsmobile Division of GMC on "Service Control System." More than 250 attended the dinner and heard Mel B. Lindquist, superintendent of labor relations, Ford Motor Co., speak on "Responsibility in Collective Bargaining." A philosophy of joint responsibility between union and company – responsibility to the American public as well as to each other – was named as the only means of making collective bargaining effective.

Greetings from the SAE Council were presented by Councillor R. J. S. Pigott, Gulf Research and Development Co.

Shown at dinner at Pittsburgh Section 17th Anniversary meeting are (l. to r.): Section Chairman Charles Butler, dinner speaker Mel B. Lindquist, Ford Motor Co., and SAE Councilor R. J. S. Pigott, Gulf Research and Development Co.

Section Reports

"Man-made rubber is the only kind geared to meet today's demand, and the probabilities are that this condition will continue throughout 1947 as well," E. Waldo Stein, Firestone Tire and Rubber Co., reported to the **INDIANA SECTION**, April 11. "We don't know," he continued, speaking on "The Future of Rubber in the Automotive Industry," "the future supply, its price, or availability of natural rubber two, three, or five years hence." However, he said, the background acquired during five years of intensive work on synthetic rubber may add up to great discoveries soon in this field.

NORTHERN **CALIFORNIA SECTION** members and guests participated in a field trip to the $23,000,000 Ames Laboratory of the **NACA** at Moffett Field,. Highlights of the inspection tour were the world's largest wind tunnel, with a throat size of 40 x 80 ft and wind velocity of 250 mph, a 16-ft throat wind tunnel for exploratory research on military models and full-scale nacelle tests, and two supersonic wind tunnels.

Questions following presentation of Stephen Johnson, Jr.'s paper on "Brakes – Fundamentals, Design and Performance" at the **NORTHWEST SECTION** meeting, April 5, elicited the assertion that aluminum brake drums, with some hard liners to provide a durable braking surface, are certainties for the future. Although disc-type brakes are satisfactory, Mr. Johnson said, their cost is considerably higher. There is hope, he believes, that some progress will be made in the direction of increased legal widths – perhaps 102 in. Questions from the floor indicated considerable interest in providing some means of compensating in braking pressure for the shift in weight when a loaded vehicle is on a curve. Tires as well as brake linings, Mr. Johnson said, should be balanced to provide uniform braking on all wheels. (Digest of **Mr. Johnson's paper appears on p. 49 of this issue.**)

Four decades will see the end of the piston engine; the jet engine will be good for about one decade after that, and then we will have atomic power, SAE Past-President A. T. Colwell, vice-president, Thompson Products, Inc., predicts. Speak-

Speaker and Section officers at Dayton Section meeting (l. to r.): W. H. Geddes, vice-chairman; T. R. Dinsmore, chairman; A. T. Colwell, Thompson Products, Inc., guest of honor; and Fred E. Lehman, Aeroproducts Division, General Motors Corp., Section meetings chairman

ing on "Automotive Trends on the Ground and in the Air," at **DAYTON SECTION'S** April 16 meeting, Mr. Colwell said that the tendency of automobile manufacturers is to avoid the radical; thus small companies probably will be the first to bring out rear engines, 4-wheel drive and so on. Other predictions: pressure cooling, an end to L-head engines and the straight eight, more compact engines . . . and a replacement of body stylist by engineer. Automobile engines should be capable, he believes, of operating at temperatures from —40 F to 120 F with considerable rough treatment. There probably will be an increase in rpm with the use of automatic transmissions in future cars.

Committee was appointed at **HAWAII SECTION'S** April 15 meeting to codify territorial, city and county laws, and present a report of actual and potential transportation needs in this respect. There is considerable conflict, it was reported, between different localities, particularly as far as length, width and weight restrictions are concerned. R. L. Muller, assistant manager of Honolulu Construction and Draying Co., spoke on "Observations of Mainland Automotive Developments."

turn to p. 47

3. Outline of instrumentation and procedure for obtaining helicopter flight test data,
4. Study of the possibilities of standardization of spline sizes for both main and tail rotor drive shafts and hub mounts.

The first project, landing gears, was assigned to M. E. Gluhareff, Sikorsky Aircraft Division, United Aircraft Corp., who will initially analyze Army, Navy, and CAA helicopter landing gear requirements and the difficulties in meeting them. Special emphasis in this project will be given to design criteria for floats and strength in loading.

Wide discrepancies in the various methods of estimating performance and the lack of correlation between performance estimates and actual flight operation will be investigated by a subcommittee which will attempt to develop techniques for closer agreement between theory and practice.

In line with the desirability of performance correlation is the need for an acceptable procedure and instrumentation for obtaining helicopter flight test data. This problem concerns itself with determination output at various phases of flight.

Standardization possibilities, as noted in the last project listed above, would be highly desirable from several aspects. Within defined power ranges, standardization would improve interchangeability of parts, facilitate testing on standard test stands, and generally simplify procurement of "hard to get" items such as universal joints and couplings.

A project of considerable importance to the industry already under way is the preparation of an Aeronautical Recommended Practice in which will be crystallized the desirable characteristics for helicopter engines. This publication may go a long way toward furthering the art by providing the designer with the first consolidated set of guiding criteria. The ARP has been submitted to the Engine Subdivision of the SAE Aeronautic Committee for review and comments prior to final issuance.

Shock Strut Tests, Standards Under Way

SAFER aircraft landing for the civilian pilot is envisioned by Committee A-12, Aircraft Shock Struts, of the SAE Aircraft Accessories and Equipment Subdivision, through its standardization program now being planned and through the development of recommended drop test procedures for the Civil Aeronautics Authority.

Standardization of shock strut units and parts in the commercial and light aircraft field is to be initiated in the near future. Chairman C. V. Johnson, Bendix Aviation Corp., has attacked the problem by submitting a questionnaire to the committee members soliciting recommendations regarding items in the aircraft shock strut field which might lend themselves to standardization. This project is in line with a general program under way in the SAE Aircraft Accessories and Equipment Subdivision to give consideration to standardization of items for commercial and light aircraft application.

The Committee has embarked upon a program, at the request of the CAA, to develop recommendations for shock strut drop test procedure simulating actual landing for possible inclusion in the manual on CAA requirements. In a discussion of the ramifi-

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HELICOPTER DESIGN

outline some problems . . . sugge

Design . . .

Digest of paper

by F. LANDGRAF
Landgraf Helicopter Co.

■ So. California, Nov. 1

(Paper entitled "Helicopter Design Problems")

COMPLAINTS about today's helicopter are numerous and well-merited, according to Mr. Landgraf. No model is free of one or more of the defects of ugliness, noisiness, roughness, tricky flying characteristics, expense, unsound mechanics or poor load-carrying ability.

Appearance has been temporarily and, he believes, rightly, neglected for the more urgent mechanical problems. Aircraft engines are inherently noisy, and little has been done to correct this, chiefly for lack of incentive. When acoustical engineers have eliminated exhaust noise, the prime offender, other noises will emerge – piston clearances will have to be reduced, back lash in the valve mechanism eliminated, carburetor air intake equipped with a silencer, and something done about gear noises in the accessory drives.

Aerodynamic roughness is peculiarly pronounced in helicopter design: air velocities and directions fluctuate rapidly over the blades as the rotor disc advances edgewise through the air. Hinged blades are becoming complicated without actually solving this problem. Addition of web-like cables from blade to blade, or of hydraulic snubbers as dampers in each blade root, tend to introduce other difficulties.

Best remedies in his opinion are to increase blade stiffness; balance the machine in order to reduce the magnitude of control displacement required, perhaps by means of a horizontal stabilizer; obtain control by cyclic displacement of a blade aileron rather than movement of the entire blade; and increase the number of blades for more nearly continuous action. Another possibility is to let the air forces shake the rotor, and isolate it from the rest of the aircraft with flexible mounts.

Problem of flying difficulty is accentuated by the six kinds of motion possible in the helicopter. Some designers feel, he said, that automatic means of returning the machine to stability from any one of these deviations is vital, while others regard this as unessential. He believes some such means, either control forces or inherent stability, must be provided. The how is unimportant, so long as the pilot does not have to do it. The simplest mechanism is, of course, the best.

There should be some utilization of the mechanism which gives airplane controls their tendency to return to neutral when released.

Simplification of design will contribute to cost reduction. Identical right and left hand rotors are cheaper to manufacture than a large lifting rotor and a small torque-converting rotor, for instance. Another economy measure is the reduction of necessary cooling hp, of transmission loss, or of loss for torque compensation, since hp is proportional to cost. Although cost falls as volume increases, he said, actually cost must be reduced in order to obtain volume production.

Helicopter improvement may receive an important boost, he reported, when and if Government testing facilities for helicopter components become available. Parts can be life tested at 20% excess rpm, and at 100% excess power for 50 hr to show any serious defects, after which a general test on the complete machine will determine performance and suitability for the intended purpose.

As for future trends, he expects a characteristic type of powerplant to develop. Design efforts should be directed toward the development of a complete power package. Although eventual use may be made of turbines or combined piston and turbine engines, he feels that powerplants in the 100-500 hp range are a more immediate necessity. The type of engine is unimportant so long as it gives smooth, quiet operation, good fuel economy throughout the required power range, good idling and rapid acceleration. Improved fuels and cylinder head design, and faster possible engine speeds, should make a lighter-than-prewar engine feasible. He believes a 500 hp unit can be built to weigh no more than 1.4 lb per hp, and a 100 hp unit to weigh perhaps 1.88 lb. Savings in fuel and structure will offset the increase in cost.

Landgraf model H-2 experimental helicopter

Development...

Digest of paper

by BERNARD W. SZNYCER
Consulting Aeronautical Engineer

■ Canadian, Nov. 21

(Paper entitled "The Helicopter: A Very Significant Aeronautical Development")

DEVELOPMENT of a successful helicopter is largely the responsibility of automotive engineers, according to Mr. Sznycer. In fact, he said, significant improvement has been hampered not by any basic aerodynamic problems, but by the limitations of mechanical engineering. Fundamental troublemaker now is weight: although jet application may improve this side of the picture in the not too distant future, present efforts must be directed toward lightening gears, clutches, free wheeling units, shafts, bearings, seals and so on.

Design procedure begins with a decision as to load carrying capacity and performance specifications, followed by a rough estimate of gross weight. From this starting point, specific design problems can be met.

Choice of rotor type – number, shape, weight and speed of blades – is the concern of the aerodynamicist, but the deciding factors are mechanical problems and cost of the mechanical parts. Each type of blade has its own problems of attachment and requires some provision against friction. Important, therefore, is a light bearing which can take a high thrust load and a fairly large radial load in oscillatory movement.

Universal joint attachment for rotor blades, he reported, will produce a lighter blade; but too much freedom in view of forces which change constantly about the periphery in forward flight may produce undesirable vibrations, which will necessitate design of new vibration dampers and shock absorbers. This raises the metallurgical problem of alloy steels with high endurance limits, and heat treatment which will allow for final machining to avoid production expenses.

There are a large number of other problems which still require extensive study:

Control now is accomplished by changing the pitch of the blades either simultaneously or collectively. Loads on controls vary about the periphery, and usually a stabilizing effect is produced by the hand of the pilot on the stick. Since forces can vary as much as 600 times per min, high precision is necessary to fly the present machine

NGINEERS

ome solutions

Perhaps a completely or partly irreversible control system like that of an automobile may be adapted for safety and flying ease.

The speed reduction unit must be capable of reducing speed ten times, sometimes more. The author believes a planetary transmission will be used, and some kind of bevel gears if angular power transmission is required. The variable speed transmission problem derives from the fact that the best rotor speed for vertical take-off is not the most efficient for high speed forward flight.

The problem of delivering power from an engine which is vibrating in one direction at one frequency to a reduction unit on a different vibration schedule introduces a need for universal joints or flexible couplings, which must be made much lighter than they now are.

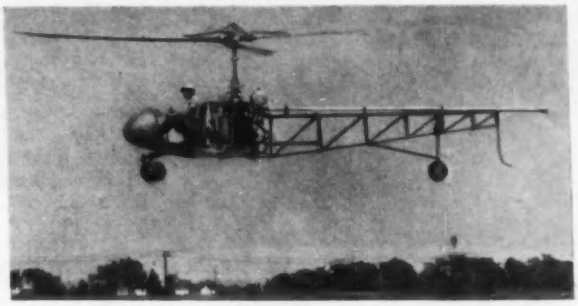
Clutch and fluid drive must be lighter, if either is to be used to avoid rapid starting overload.

Principal lubrication problem is how to provide enough oil for the gears without overoiling bearings. Pressure lubrication requires oil pumps, oil coolers, and mechanical seals to prevent leakage.

Mechanical problems are possible of solution, he said, but should be handled by specialists instead of individual helicopter designers. Standardization will lower the cost.

Aerodynamic problems . . . high peripheral speed approaching the speed of sound and therefore limiting the size of the rotor and its load carrying capacity, and forward speed . . . are, in his opinion, no more alarming than the supposed limitations on speed of conventional airplanes, which jet propulsion has overruled.

Thus, he said, in summary, helicopter development needed and still needs the efforts of the automotive industry to give light alloys for housings, high tensile strength steel alloys for machined parts, ground spiral bevel gears, methods of grinding spur gears, and bearings, clutches, joints and overrunning units. Of additional vital importance are the research contributions of aerodynamics and engine designing. Once considerable standardization has been introduced, he believes, the helicopter will show itself admirably suited to mass production methods.



Franklin engine installed in helicopter

Powerplant . . .

Digest of paper

by CARL T. DOMAN

Aircooled Motors Corp.

■ So. California, Nov. 1

(Paper entitled "General Requirements for Helicopter Engines")

BASIC requirements for helicopter powerplants are six, Mr. Doman announced: maximum power, maximum weight, maximum reliability, ability to overspeed, ease of servicing and minimum cost. Each specification modifies the others, so that final design represents an engineering compromise.

Since 1940, he said, the Sikorsky VS-300 helicopter has been developed to produce greater and greater power through increased hp and increased piston displacement, until a 199-cu-in. piston displacement has resulted in an engine developing 100 hp at 3000 rpm. The underlying principles of helicopter design tried and proved in this model have been incorporated in Army helicopters.

Mr. Doman reiterated Mr. Landgraf's insistence on a package power unit to reduce overall weight; a low-cost engine, with some of the excess power used as a reserve to provide for vertical take-offs from fields above sea level; smooth, quiet operation for long periods of time with minimum fuel consumption; and rapid acceleration, because of the importance of the throttle as a flight control. If cost can be reduced through mass production, he said, light weight superchargers might prove practicable.

Since the slip stream does not supply cooling assistance at all times, self-cooling, either by centrifugal or axial flow fan, must be provided. The latter is, in his opinion, simpler, quieter, and more easily understood. Design of a proper fan for an engine requires evaluation of a large number of miscellaneous factors: proper design of fan entrance for minimum restriction; utilization of rubber bushings to isolate the fan from its mounting; selection of properly shaped blades, contravanes, air baffles, and so on.

Other problems gradually are being eliminated from the roster of complaints as research progresses. Crankcase breathing is corrected by a series of baffles in the engine accessory case, to direct oil flowing down from internal engine parts away from revolving gears. Extra oil seals between accessories and timing gear case eliminate the problem of extra oil delivered to these parts in a vertical engine. Repositioning the jet often takes care of uneven carburetion in vertical engines. Fuel injection seems to give better distribution, and at the same time solves the icing problem.

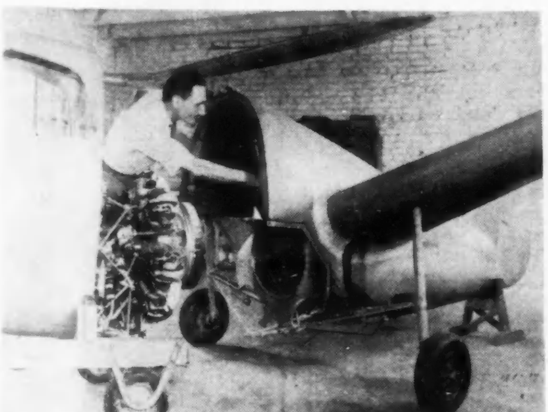
Actually, he said, mixture distribution is the joint responsibility of engine designer and carburetor manufacturer . . . maximum engine power usually is obtained by the largest possible venturi in the carburetor, but this has a tendency to aggravate the distribution problem. This in turn exaggerates cooling difficulties.

To restrain pilots from habitual overspeeding, he reported, it is possible to alter the intake system so that the power output curve will break just beyond the engine's rated speed.

Engine weight is always a compromise between cost, performance, and life. Magnesium has fatigue life disadvantages for certain parts, but aluminum has often shown good results in cooling and weight saving.

Since a basic helicopter design has not yet emerged, Mr. Doman explained, it is impossible to set up specific requirements for powerplants. New special engines are expensive to develop; consequently, for the present at least, the engine maker's problem is to adapt existing designs to helicopter installations.

turn to p. 49



Landing gear and method of joining fuselage and aft section on model H-2. Mr. Landgraf is shown making an adjustment

About S

Ernest R. Breech

ERNEST R. BREECH has become executive vice-president and a director of Ford Motor Co. Mr. Breech, a member of the SAE Finance Committee, will remain until the end of 1946 as a director of Bendix, from which he has resigned as president, effective June 30. Before becoming president of Bendix in February, 1942, he had been a vice-president of General Motors Corp. for three years and a group executive for six years. He was both chairman and president of North American Aviation, Inc., for several years prior thereto. He was first connected with General Motors in 1929, where he was always identified with aircraft and home appliance production.

WILLIAM P. MICHELL has been named technical assistant to the vice-president of Spicer Mfg. Corp., Toledo, Ohio. Until recently executive engineer and assistant chief engineer of Mack Trucks, Inc., Allentown, Pa., Mr. Michell brings to Spicer a broad experience in the truck and bus field from his 23 years with Mack Trucks. Born in Warren, Pa., he received his degree in mechanical engineering from the University of Pennsylvania in 1916. Early engineering experience was gained with the Whitlock Mfg. Co., Hartford, Conn., and the Barrett Co., New York City. After that he served for two years as a first lieutenant in the U. S. Army Corps of Engineers in France in World War I. Following a couple of years as engineer-superintendent with the

William P. Michell

Ace (later Indian-Ace) Motorcycle Co., Philadelphia, Mr. Michell joined the Mack Trucks organization and served successively as engineering assistant to the factory manager, executive engineer, and assistant chief engineer. He is chairman of the Motorcoach and Motor Truck Technical Committee.

PAUL B. PHILLIPS has become a partner with C. E. Phillips & Sons, Durham, N. C. He was formerly a consulting resistance welding engineer in Dallas, Tex.

Formerly in the development engineering department of Thompson Products, Inc., Cleveland, **JAMES G. RUSPINO** is now electronic technician's mate third class in the U. S. Navy.

Formerly a student member at M.I.T., Cambridge, Mass., **V. N. MEHTA** is now a student engineer with the Chrysler Corp., Detroit.

COM. NEIL MacCOULL, USNR, has returned to the Beacon Laboratories of the Texas Co. as consulting engineer after a military leave of absence of nearly three years. This is the second time that Commander MacCoull has returned to the Texas organization after military service, the first time being 27 years ago after service with the Naval Air Forces in France. He has had experience with airships in the Naval Reserve since 1928 and on training duty flew in the rigid airships U.S.S. Akron, Los Angeles, and Macon. Upon reporting for duty in World War II, he was assigned to the "Home of the Dirigibles" at the Naval Air Station in Lakehurst, N. J., as airship powerplant engineer. As extra duty he held various appointments such as assistant experimental officer and laboratories division officer in charge of the Chemical, Physical and Engine Experimental Laboratories. Commander MacCoull has been credited with several improvements in the operation of the engines of the lighter-than-air craft and the electrical reverse pitch propeller installations used on them. On March 1, he completed 27 years of service with the Texas Co.

O. E. SZEKELY, after serving for three and one-half years with the USNR, has returned to his former associates and practice as automotive, aircraft, and industrial consulting engineer under the firm name of O. E. Szekely and Associates with offices at Philadelphia. Mr. Szekely was serving as a commander at the time of his release from the Navy.

DAVID H. MIKKELSON has recently joined the Honolulu Rapid Transit Co., Ltd., as automotive engineer. His duties include assisting the superintendent of equipment in matters of automotive engineering shop layout, preventive maintenance, installing and operating dynamometers, designing special equipment, and handling personnel relations. Mr. Mikkelson was released from the U. S. Army in March as a lieutenant-colonel.

ROGER F. MATHER has been appointed chief metallurgist of Kaiser-Frazer Corp. and Graham-Paige Motors Corp. Formerly chief metallurgist at Willys-Overland Motors, Inc., Mr. Mather was in charge there of specifications and testing of all materials used in building the war-famed jeep and other war materiel. Before joining Willys-Overland, he was with the Inland Steel Co., Chicago. A native of London, England, he is a graduate of Cambridge University and M.I.T.

Formerly manager of aeronautical sales and engineering with the General Tire & Rubber Co., Akron, Ohio, **ROBERT D. SPENCER** is now a partner and consulting engineer with Spencer, Peterson & Co. of Kansas City, Mo.

T. C. SMITH, American Telephone & Telegraph Co., New York City, was named to represent SAE President L. **RAY BUCKENDALE** at the meeting of the Thomas A. Edison Centennial Committee on May 7. The committee has been formed to coordinate public interest in the inventions of Edison.

E. J. BRYANT has recently been named Detroit district manager of the Greenfield Tap & Die Corp., Greenfield, Mass. Mr. Bryant was formerly director of research with the same company.

E. J. Bryant

E. J. vanDYK has been named petroleum industry field engineer and district manager of sales for the Detroit Diesel Engine Division of General Motors Corp. The appointment entails supervision of the district which includes Oklahoma, Kansas and Illinois. A mechanical engineering graduate of Wayne University, Detroit, Mr. vanDyk joined General Motors in 1939. His background includes all phases of mechanical engineering – experimental, laboratory, designing and field work. With the Detroit Diesel Engine Division, his work has been to head up the study of various phases of the application of the GM Series 71 diesel engine to oil well drilling and oil pumping operations. Much of his time has been spent in the field, setting up drilling rigs and working with drilling rig manufacturers. Mr. vanDyk will make his headquarters at Tulsa, Okla., and will work out of the General Motors Petroleum Industry Sales office there.

E. J. vanDyk

SAE Members

J. HOWARD **PILE**, who became business manager of the magazine ***Fleet Owner*** of New York, the first of the year, has now been made editorial director and business manager, and as such will direct both the business and editorial activities of the organization. Previous to joining ***Fleet Owner,*** Mr. Pile had been vice-president and editorial director of the Chek-Chart Corp. of Chicago, for 15 years. He is a past-chairman of SAE Chicago Section.

S. E. RUSINOFF has recently been appointed assistant professor of mechanical engineering at the Illinois Institute of Technology, with which he has been connected as a faculty member since 1941. Prior to his engagement with the Institute, he was connected with Borg-Warner Corp., Chicago. Professor Rusinoff has recently completed a new textbook, "Practical Descriptive Geometry," which is being published by the American Technical Society of Chicago. The book is designed both for use by technical schools and as a reference for engineering departments and drafting rooms.

N. F. STOCKBRIDGE has been elected chairman and managing director of General Motors, Ltd., London, England. He assumes his new post in addition to his duties as chairman of General Motors' other British companies – AC-Sphinx Sparking Plug Co., Ltd., Frigidaire, Ltd., and Delco-Remy & Hyatt, Ltd.

C. J. WILSON has been named vice-president in charge of production and technical sales service of the Mergraf Oil Products Co., Inc., of Detroit. Before joining the Mergraf organization, he was a chemical engineer with the Acheson Colloids Corp., Port Huron, Mich.

Formerly design engineer with the Superior Engine Division of the National Supply Co., Springfield, Ohio, **ERVIN A. LAUCH** is now chief engineer of the Research Engineering Corp., La Porte, Ind. Mr. Lauch is treasurer of SAE Dayton Section.

Among the 10 pioneers of the motor car era selected for the Automotive Hall of Fame by the Automobile Manufacturers Association and the National Automotive Golden Jubilee Committee, these five are or have been SAE members: **J. FRANK DURYEA, HENRY FORD,** who was the Society's first vice-president: **GEORGE M. HOLLEY, CHARLES B. KING** and **ALFRED P. SLOAN, JR.** Chairman of the industry committee which made the announcement was **WILLIAM S. KNUDSEN,** who retired some time ago from his wartime duties as lieutenant-general.

SAE Past-President **DR. H. C. DICKINSON** will be the honor guest at the annual dinner of the Committee on Petroleum Products and Lubricants of the American Society for Testing Materials on June 25 in Buffalo. Each year the Committee selects a guest of honor on the basis of technical and other contributions to the work of the Committee. Attendance at the dinner represents a good cross-section of American industry.

ADOLF GELPKE, production manager, Autocar Co., Ardmore, Pa., has been appointed a member of the Production Activity Committee of the SAE according to an announcement by SAE Production vice-president **NEIL A. MOORE.**

EMORY S. LAND, president of the Air Transportation Association, was guest of honor and speaker at the second Annual International Civil Aviation Luncheon held at the Hotel Roosevelt on May 2. Vice-Admiral Land, one of the country's leading aviation figures, recently resigned as chairman of the U. S. Maritime Commission, with which he has served for nine years. The luncheon was held under the sponsorship of the Aviation Section of the New York Board of Trade, Inc.

THOMAS WOLFE has joined the United-Rexall Drug Co. as assistant to the president. Mr. Wolfe recently resigned from Western Air Lines, Inc., Los Angeles, after serving for 10 years as vice-president of traffic and advertising. Prior to his association with Western Air Lines, he was district manager of United Air Lines, Inc., in Chicago, from 1927 to 1936. Mr. Wolfe is

Thomas Wolfe

a member of the SAE Air Transport Activity Committee and also vice-chairman representing air transport for SAE Southern California Section.

Rex B. Beisel

REX B. BEISEL, general manager of Chance Vought Aircraft Division of United Aircraft Corp., East Hartford, Conn., has recently been elected a vice-president of United Aircraft. Mr. Beisel, who joined Chance Vought in 1932, assumed the managership when it became a division of the company three years ago. Mr. Beisel is a member of the SAE Technical Board.

ARTHUR E. RAYMOND and **RONALD M. HAZEN** have been appointed by President Truman to the National Advisory Committee for Aeronautics. SAE Past-President **EDWARD WARNER,** who is now president of the Interim Council of the Provisional International Civil Aviation Organization, has recently resigned as a member of the NACA. Mr. Raymond is president of the Institute of the Aeronautical Sciences and vice-president in charge of engineering of Douglas Aircraft Co., Inc. Mr. Hazen is chief engineer of Allison Division of General Motors Corp. and is responsible for the design of the Allison engine which powered the Lightning fighter planes of World War II. Mr. Raymond is serving as a 1946-1947 SAE Councilor.

CHARLES W. PERELLE, formerly vice-president in charge of manufacturing of Consolidated Vultee Aircraft Corp., and who rose in seven years from a tool designer to be vice-president of Hughes Tool Co., has been elected president of Gar Wood Industries, Inc. He succeeds **GLEN A. BASSETT,** retired. As vice-president of Convair, Mr. Perelle was responsible for the

Charles W. Perelle

production of more than 30,000 military aircraft, including the famous four-engined B-24 Liberator bomber, and was in charge of more than 100,000 employees in the

company's 11 plants. **GARFIELD A. WOOD,** founder of the company, retired from board chairmanship more than a year ago.

TOM B. LINTON has recently formed his own company, Kartron, Inc., of Alhambra, Calif., with which he is serving as president. He was formerly consulting engineer with Allite Mfg. Co. and Schrader Electronic & Coil Corp. The Kartron organization manufactures the Kartron coil checker and electronic wave filters for producers of airborne radio equipment.

Tom B. Linton

STEPHEN KALMAR, AC test engineer in charge of the Engineering Testing Laboratory of the AC Spark Plug Division, General Motors Corp., has transferred to the GMC Product Study Division, Powerplant Development Section.

Formerly assistant to the chief engineer of Kinnear Mfg. Co. of Calif., San Francisco, **S. V. BURBERICK** is now a partner in the Burberick Motor Sales Co., San Mateo, Calif., Packard dealer.

W. A. TAUSSIG has been appointed assistant general manager of the Truck Division of Burlington Truck Lines, Inc., Galesburg, Ill. Formerly automotive engineer with the Burlington organization, Mr. Taussig, in his new post, will have charge of the mechanical department, labor relations, and various other duties. He is chairman, this year, of the Meetings Committee of the SAE Transportation and Maintenance Activity.

Among nominees for directors of the Engineering Society of Detroit are SAE members **PETER ALTMAN,** Detroit engineering consultant; **GEORGE CALINGAERT,** director of chemical research, Ethyl Corp.; **VAN M. DARSEY,** president, Parker Rust Proof Co.; **RUSSELL H. McCARROLL,** executive engineer, Ford Motor Co. **WALTER J. KINGSCOTT, JR.,** a student member of SAE, has been nominated as a candidate for secretaryship of the Junior Section of the Engineering Society.

WILLIAM H. BEAN has recently joined the Third Avenue Transit Corp., New York City. He was formerly an engineer with the Surface Transportation Corp., same city.

J. HARLEY OTIS has been reappointed accessory sales manager of Pontiac Motor Division, General Motors Corp., Pontiac, Mich. With General Motors since 1922, Mr. Otis was transferred in March 1942 to the purchasing department where he filled a special assignment on war work until he returned to his present position in the sales department last November. Starting as a technical member of the service department in the central office of the Oakland Motor Car Co., he became in 1926 assistant service manager. He continued in this capacity until the formation of the BOP Sales Division in 1930. He served with BOP Sales Division as assistant service promotion manager until it was dissolved in 1933. His next assignment was with Pontiac Chicago region and in 1934 he returned to the Pontiac central office as assistant service manager. Just prior to joining the purchasing department in 1942 he was accessory sales manager with Pontiac Motor Division.

J. Harley Otis

PAUL H. WILKINSON, consulting engineer, 216 E. 46th Street, New York 17, has just published "Aircraft Engines of the World, 1946," a 340-p., illustrated volume, including a new section of 52 pp. of 20 jet propulsion powerplants. In addition to the standardized data pages, with dimensions and capacities in both the U. S. and metric systems, the sections on reciprocating and jet engines contain comparative tabulations of the equipment described. Brazil, Spain, Sweden, and Switzerland have been added in the new edition.

HENRY FORD II has been chosen to receive the Christian Culture Award medal for 1946 from Assumption College of Windsor, Canada. The medal is awarded annually to an outstanding lay exponent of Christian ideals.

ANDREW L. POMEROY has been promoted to engineering operations manager of Ranger Aircraft Engines, division of Fairchild Engine & Airplane Corp. He has been serving as chief project engineer. Before joining Ranger, he was an automotive engineer in the research and development division of the Atlantic Refining Co.

With a suggested master key to aviation development: "Let us take inventory of America's airports, match them against the potential need, and if they are lacking, let us see what business and Government can and should do to remedy the situation," **T. P. WRIGHT,** CAA Administrator, addressed the U. S. Chamber of Commerce Annual Meeting at Atlantic City on May 2. After reviewing the airport situation, Mr. Wright then outlined a "National Airport Plan," aimed at achieving a uniformly adequate distribution of airports – for town and country; for heavily populated industrial areas, and for states with long stretches of sparsely settled land between population centers. The foundation, he said, of our air development program is adequate airports.

HOWARD H. DIETRICH has recently joined the Rochester Products Division of General Motors Corp. During the war period, Mr. Dietrich was at Yale University doing special engineering research work. Before that, he was engaged for several years at American Bosch Corp., Springfield, Mass., in engineering development of fuel injection for aircraft engines and diesel engines. With Chrysler Corp. in Detroit, he was engaged for 13 years in the development of carburetion, fuel injection, and various other engine projects.

Howard H. Dietrich

T. D. KING has been named manager of the Atwood Distributing Co., Ltd., Lihue, Hawaii, which is agent for the Shell Oil Co., Inc., on the island of Kauai, T. H. Mr. King has recently been released from the USNR with which he has served for three and one-half years as a lieutenant (jg).

C. R. MABLEY has retired after 31 years of service from the sales staff of SKF Industries, Inc., Philadelphia. He joined the organization in 1915 and for a number of years was manager of the Detroit district office. Since 1941 he has been priorities manager in the home office in Philadelphia. Early in his automotive career, Mr. Mabley and a partner converted their automobile repair shop in New York City and successfully manufactured the "Simplex" motorcars. Mr. Mabley and his partner were the first to use the principle of interchangeable tires. He also introduced the automobile-type vertical engine to small boats. Known as "Autoboats," they were the forerunner of today's motorboats. He also was the organizer and first president of the "Automobile Salon," a display of foreign cars along the lines of today's automobile shows.

Formerly an engineer in the research department of the Caterpillar Tractor Co., Peoria, Ill., **WILLIAM A. CASLER** is now a research engineer in the Mechanics Division of the Armour Research Foundation of Chicago. Mr. Casler was 1944-1945 vice-chairman of SAE Peoria Section.

R. J. S. PIGOTT was named to represent SAE President L. RAY BUCKENDALE at the George Westinghouse Centennial Forum held at Pittsburgh, Pa., on May 16, 17, and 18. The forum, entitled "Science and Life in the World," was comprised of symposia and addresses arranged to provide an opportunity for scientists, engineers, and scholars to correlate present knowledge and to consider subjects for future research. The forum was sponsored by the Westinghouse Educational Foundation.

Formerly stress analyst in the structural methods department of Lockheed Aircraft Corp., Burbank, Calif., MARVIN STERN is now serving in a similar capacity with Republic Aviation Corp., Farmingdale, L. I., N. Y.

DONALD FAIRBAIRN, manager of the Detroit district of the Industrial and Automotive Products Division of the B. F. Goodrich Co., recently completed 20 years with the Goodrich organization. A graduate of the United States Naval Academy at Annapolis, he joined the company in 1926 and for 15 years was sales engineer in the Detroit district. During World War II he was located in Los Angeles as manager of the war products division of Goodrich. He returned to Detroit last year when he assumed his present post.

V. E. MATULAITIS has become sales engineer of the Heater Division of the Eaton Mfg. Co. Dividing his time between the company's home offices in Cleveland and the Wilcox-Rich Division's offices in Detroit, Mr. Matulaitis will direct the division's experimental and development activities in connection with automobile and truck heater-defroster units and will act as engineering consultant to automobile and truck manufacturers. He was previously with the F. A. Smith Mfg. Co. of Rochester, N. Y., where he was engaged in air conditioning development projects. He is a graduate of the University of Michigan in mechanical and aeronautical engineering.

V. E. Matulaitis

Robert P. Russell (left), president of Standard Oil Development Co. of N. J., is shown receiving the Naval Ordnance Development Award for his company from Capt. Norman W. Ellis, USN (right). In the center is F. W. Abrams, chairman of the board of the company

For "distinguished service" in the development and design of the Navy's Mark I flame thrower and its devastating jellied gasoline, Standard Oil Development Co. of N. J., on May 7 was presented with the Naval Ordnance Development Award. At the left is SAE member ROBERT P. RUSSELL, president of the company, shown receiving the certificate from Capt. Norman W. Ellis, USN (right), assistant director of research and development, Bureau of Ordnance, Washington, D. C. In the center is F. W. Abrams, chairman of the board of the company.

For especially meritorious conduct in the performance of outstanding war services in the United States, Mr. Russell was also awarded the Medal of Merit on May 8 by Major-Gen. Alden H. Waitt, chief, Chemical Warfare Service. A citation from President Harry S. Truman, praising Mr. Russell for his direction of research and development of flame throwers, incendiaries, and smoke generators, read in part: "He directed with unbounded zeal many projects and his enthusiasm permeated his entire operating staff. Mr. Russell visited theaters on three occasions to get first-hand information and to see for himself the results of his efforts in the field. His untiring efforts and successful results reflect great credit on himself and the nation."

WILLIAM B. SEAVER has become senior engineer with Packard Motor Car Co., Aircraft Engine Division, Toledo, Ohio. He was assistant project engineer with Pratt & Whitney Aircraft, division of United Aircraft Corp., East Hartford, Conn.

Formerly experimental equipment engineer with Wright Aeronautical Corp., Paterson, N. J., LEWIS W. PIFER is now chief engineer of Consolidair, Inc., Alliance, Ohio.

Lewis W. Pifer

C. A. BENDER, JR., has recently rejoined the Gulf Refining Co., New Orleans, La., as motor oil division sales representative. Mr. Bender has just returned to his civilian position after serving for three and one-half years with the U. S. Navy. At the time of his discharge he was a lieutenant-commander, serving as technical officer at the office of the Supervisor of Shipbuilding, Chickasaw, Ala.

COL. F. W. HUNTINGTON, U. S. Army, has been transferred from Fort Hamilton, Brooklyn, N. Y., to Seattle Port of Embarkation, Seattle, Wash.

G. F. RACETTE has been elected president of the United Tire & Accessories Co., Tulsa, Okla. He was formerly a vice-president of the Bareco Oil Co., same city.

HENRY S. MORTON has been promoted to the rank of lieutenant-commander in the U. S. Naval Reserve and has been transferred to the Planning Division at Norfolk Naval Ship Yard at Portsmouth, Va. He

JOSEPH A. DOYLE, who has returned to the Sun Electric Corp., 556 West 54th Street, New York 19, N. Y., as branch manager, recently was discharged as a major with the Army Ordnance Department. He was in the service for nearly three years, two of which were spent overseas in the Third Army. Following the surrender, he was in charge of the rebuilding of vehicle engines in 17 factories in Paris, where powerplants were being readied for the expected Japanese invasion. During his service he received several citations for conspicuously meritorious and outstanding performance of military duty. His company, formerly the Sun Mfg. Co., manufactures motor, distributor, and other testing equipment. His listing in the SAE 1946 Roster was erroneously inserted as being with the Sun Oil Co., Philadelphia. There is no connection between these companies.

was formerly a lieutenant serving on the staff of Commander of Minecraft, U. S. Navy, Pacific Fleet.

LT. (jg) E. A. MALICK, who has been officer in charge of the Carburetion, Water Injection, and Turbine Fuel Metering Subsection of the Powerplant Design Branch, Bureau of Aeronautics, for the past two and one-half years, returned to inactive duty in April. He was formerly a research and development engineer with Bendix Aviation Corp.

S. W. IRVINE, British Overseas Airway Corp., Baltimore, Md., has been appointed to the inspection staff. He has recently been released from the RAF Transport Command.

Formerly project engineer with Allison Division of General Motors Corp., Indianapolis, Ind., **E. B. SHERRICK** is now project design engineer in the product study and power development section of General Motors in Detroit.

ORVILLE L. ADAMS has joined the Industrial Division of Prentice-Hall, Inc., New York City, and will be engaged in the development of manuscripts and the promotion of sales of industrial, trade, and apprentice training books in the eastern states. Recently released from the Navy with the rank of lieutenant-commander, Mr. Adams was, before his entry into the service in 1942, in civilian engineering and education work. He served as a ship repair officer, at a naval base in the Aleutians, and, after returning to Washington, D. C., in 1945, was active in the development of the Navy's postwar apprentice training program in the Navy Office of Industrial Relations.

WILLIAM H. WILSON has transferred to the Aluminum Co. of America. He formerly was with the service department in the Pacific Theater of Operations with Wright Aeronautical Corp.

Formerly with the Lord Mfg. Co., Erie, Pa., **JOHN M. LOGAN** is now sales engineer with the Industrial Rubber Products Division, mechanical goods section, United States Rubber Co., Detroit.

D. E. WILLIS has recently been elected president of the Durasite Corp., Tampa, Fla. He was until recently research engineer with Tampa Shipbuilding Co., Inc., same city.

Formerly associated with Socony-Vacuum Oil Co., Inc., Brooklyn, N. Y., as supervisor, **CARL E. HABERMANN** is now connected with Intava, Inc., New York City, as technical service engineer.

Until recently research engineer with J. H. Fenner & Co., Ltd., Colne, Lancs., England, **LUDWIG HEILBRUNN** is now affiliated with Rubber Bonders, Ltd., Dunstable, Beds., as chief designer. The Rubber Bonders organization produces rubber-to-metal bonded antivibration devices.

Previously checker in the engineering department of Wright Aeronautical Corp., Paterson, N. J., **WILLIAM J. FOWLER** is now serving in a similar capacity with the American Bosch Corp., New York City.

ALFRED HARLEY has joined the Machine & Tool Designing Co. of N. Y., New York City, as machine designer. He was formerly senior draftsman with the Glenn L. Martin Co., Baltimore, Md.

Previously chief inspector, Wayne Division of Bendix Aviation Corp., Wayne, Mich., **ELDRED E. EVANS** has recently joined Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio, as director of quality and liaison engineering.

T. L. ROBINSON, who had been with the S. K. Wellman Co., Cleveland, is now affiliated with the Wel-Met Co. of Kent, Ohio.

THOMAS C. LEAKE is now a consulting engineer with offices in Detroit. He was formerly director of engineering with Graham-Paige Motors Corp., same city.

Until recently manufacturing engineer, Consolidated Vultee Aircraft Corp., San Diego, Calif., **EMANUEL KESSLER** is now an industrial engineer with U. S. Electrical Motors, Los Angeles.

R. I. MAHAN, Union Oil Co., has been transferred from the Los Angeles branch of the company to Portland, Ore., where he is serving as area manager.

Formerly a student member at Yale University, New Haven, Conn., **R. M. STRAND** is now a student engineer with the Chain Belt Co. of Milwaukee, Wis.

GEORGE C. FOWLER, who had been field engineer, automotive and power section, Squire Signal Laboratory, Fort Monmouth, N. J., is now a foreman with the McGee Motor Co. of Asbury Park, N. J.

JAMES E. CHAPMAN has recently become project engineer in the electrical equipment department of the Airesearch Mfg. Co., Los Angeles, Calif. He was formerly chief engineer, design department, Airesearch Mfg. Co. of Arizona, Inc., Phoenix, Ariz.

OBITUARIES

Carl D. Peterson

Carl D. Peterson, executive chief engineer, Spicer Mfg. Corp., died recently at the age of 59.

Active in the automotive industry since 1907, Mr. Peterson started his engineering career with the Babcock & Wilcox Co. of Barberton, Ohio, where he broadened his background with machine-shop, engine-room, and drafting-room practice, and machine repair work. He joined International Harvester Co. in 1910, and in 1912 became associated with the Lippard-Stewart Motor Car Co.

Mr. Peterson became a member of SAE in 1912.

Stoddard B. Martin

Stoddard B. Martin, owner of the S. B. Martin Co., Cleveland, died recently at the age of 53. Mr. Martin organized his company in 1924 and since that time had become a tooling and production expert and also a sales engineer. He had worked closely with the design and tooling departments in adapting machines of the Cone Automatic Co., Inc., for use in large plants, one of which was the Timken Roller Bearing Co. Before formation of his company, he was associated with the Knob Products Co. of Buffalo, N. Y., and the National Acme Co., Windsor, Vt.

He became a member of SAE in 1943.

Joseph Cermak

Joseph Cermak, chief tool designer with the Cleveland Graphite Bronze Co., Cleveland, died Feb. 3. He was 69 years old.

Mr. Cermak's early engineering experience was gained at the Remington Arms Co. and Remington Typewriter Co., where he served as assistant chief tool designer and later tool designer. He served for a time as engineer of equipment with the Elliott-Fisher Co., Harrisburg, Pa. He joined the Gramm Motor Car Co. of Lima, Ohio, in 1910, one year before he joined SAE.

Joseph C. Coulombe

Joseph C. Coulombe, 63, retired engineer and inventor of Del Mar, Calif., died April 16. A native of St. Thomas, Quebec, Canada, Mr. Coulombe came to Del Mar, from Kokomo, Ind., where he was with the Bryne Kingston Mfg. Co. as chief engineer. He was the owner of 200 patents on fuel feeding devices for automobiles and other automotive equipment. He was a graduate of Norwich University of Northfield, Vt.

John L. Parks

John L. Parks, maintenance superintendent, Associated Transport, Inc., Baltimore, Md., died in December, 1945, at the age of 40.

Mr. Parks started his engineering career as a mechanic with the Mecklinburg County Highway Commission, Charlotte, N. C., where he was engaged in passenger car, truck and tractor repair. Since then his work had been concerned principally with shop and equipment maintenance. Just prior to joining Associated Transport, Mr. Parks was development service engineer with Briggs Clarifier Co.

Mr. Parks joined the SAE in 1935.

Capt. Leonard H. Witt

Capt. Leonard H. Witt, U. S. Army, was killed in action while serving in the China-Burma-India theater about a year ago. Captain Witt was 38 years old.

Shortly after his graduation from Rose Polytechnic Institute in Terre Haute, Ind., in 1931, he joined Caterpillar Tractor Co., where he advanced to sales engineer in charge of general sales promotion, including college contracts, advertising and merchandising. He left Caterpillar in 1942 to join the U. S. Army Corps of Engineers.

J. Donald Roach

J. Donald Roach, 44, died March 19 after a three-month illness. Mr. Roach was sales engineer with the U. S. Asbestos Division of Raybestos-Manhattan, Inc., Manheim, Pa.

Prior to joining the Raybestos-Manhattan organization in 1932 as sales engineer, he was a salesman with the David Brake Co., Philadelphia. From 1924 to 1926 he was associated with DeBraw Chrysler Service and in 1923 served with the Philadelphia Electric Co., where he was engaged in general shop automotive work.

Shock Struts

cont. from p. 35

cations of the project with E. I. Ryder of the CAA, the Committee pointed out that factors to be considered in such recommendations are flexibility, geometry or arrangement of the gears, and tire size on both conventional and tricycle landing gear. Another decision the Committee will have to make in preparing recommendations is whether test drops should be horizontal or inclined. In reply to Mr. Ryder's question on the effect of operational wear in service on test results, Mr. Johnson stated that his experience with test of service struts revealed that wear does not materially alter test results.

Serving with Mr. Johnson on the Committee are: E. Caprioglio, Grumman Aircraft Engineering Corp.; R. E. Kibele, Curtiss-Wright Corp.; C. E. Deardorff, Douglas Aircraft Co., Inc.; W. Eldred, Consolidated Vultee Aircraft Corp.; D. Wark, American Airlines, Inc.; J. F. Wallace, Cleveland Pneumatic Tool Co., and W. G. Wood, Menasco Mfg. Co.

New Threads Studied by SAE-ASME Group

IMPORTANT advances in screw thread standardization were made at a recent meeting of the SAE-ASME sponsored Sectional Committee on Standardization and Unification of Screw Threads, B1, under the American Standards Association. Among the major projects discussed and given unanimous approval as to method of attack and final goal were:

1. Development of a new class of screw thread fits and; (2) Modification of the American-British-Canadian thread form proposed at the Ottawa Conference.

Development of a new series or class of screw thread fits, having an allowance on the pitch diameter below basic, was prompted by two problems with respect to screw thread assemblies confronting industry for some time now. First are the difficulties encountered in assembling with high-cycle wrenching; and second, the determination of proper clearances to allow for plating of both external and internal threads. These difficulties are prevalent in automotive production wherein screws are largely used in tappet holes rather than in nuts and a suitable standard class of fit is sorely needed.

Based upon the recommendations of a subcommittee which submitted a report to Committee B1 proposing adoption of a new class of external tolerances and allowances, to be designated Class A, a subcommittee, under the chairmanship of SAE member H. L. Keller, General Motors Corp., was assigned to develop the details of the class of clearance fits. A second group will simultaneously and independently study development of thread tolerances for commercial nuts.

With regard to the second project, the Committee reached an important decision in approving revision of ASA Standard B1.1-1935 to include the basic ABC thread form – proposed at the Ottawa Conference, held in the fall of 1945 – with modifications to be made acceptable to American interests. Minor modifications to the proposed thread form will be referred to subcommittees appointed to handle special phases.

The newly reorganized SAE Screw

Threads Committee will act as a liaison for the automotive industry with Sectional Committee B1. All final action taken by the joint SAE-ASME group will be cleared through the SAE Screw Threads Committee and the Technical Board prior to adoption as American Standard.

Members of Sectional Committee B1 representing the SAE are: A. Boor, Monroe Auto Equipment Co.; G. S. Case, Lamson & Sessions Co.; E. H. Ehrman, Chicago Screw Co., and H. A. Marchant, Chrysler Corp. Other SAE members serving as members-at-large on the Committee are: Mr. Keller; W. L. Barth, General Motors Corp.; E. J. Bryant, Greenfield Tap & Die Corp.; Prof. E. Buckingham, Massachusetts Institute of Technology; G. Carvelli, Wright Aeronautical Corp.; P. M. Delzell, Ford Motor Co., and F. C. Leiner, Cadillac Motor Corp.

Spark Plug Standard Includes New Sizes

DECISIVE action on automotive spark-plug standardization was taken by a special group at a recent meeting held under the combined auspices of the SAE Electrical Equipment and Engine Committees.

Agreement was reached to revise and extend the SAE standard on spark plugs. In addition to revision of present 7/8 in.-18 and 18-1.5 mm plug standards, in accordance with latest practice, a new standard covering plug and tapped hole thread dimensions for 14-1.25 mm, 10-1 mm, 3/8 in.-24, and 1/4 in.-32 spark plugs has been tentatively proposed. It is interesting to note that the 3/8 in. and 1/4 in. spark plugs are used on small industrial engines and military equipment such as flame throwers. The 1/4 in. plug is also largely used for model airplane engines.

It was proposed to include separate illustrations in the Handbook for each size and type of plug to clarify design variations in the several sizes, particularly with respect to the portion of the plug between the hex and the threads. For example, the barrel of the 7/8 in. plug under the hex is cylindrical down to the gasket seat, while on some metric plugs this portion of the barrel tapers to the gasket seat.

The Committee's tentative proposals will be referred to spark-plug and engine manufacturers for review prior to final recommendation to the SAE Technical Board.

Development of a standard snap terminal nut was completed by E. K. Schadt, General Motors Corp., who will continue with the project for standardization of clip terminal nuts. This effort will be particularly desirable to wiring harness manufacturers in the fabrication of cable ends.

Auto Steel Castings Defined for Industry

AUTOMOTIVE steel casting specifications drafted by Subdivision X of the SAE Iron and Steel Committee aim to provide both the automotive casting purchaser and the foundry with a common medium of expression which will serve to expedite production and eliminate needless waste of time and materiel.

Stimulating this project originally was the demand of automotive steel casting users for a standard specifically designed to their needs and practices to supplement existent specifications for general industrial application. The program now under way will enable the purchaser to order castings with assurance that the foundry will know and deliver exactly what was ordered.

The proposed steel casting standard will cover tests for physical and chemical properties of castings as well as the methods of correlating laboratory inspection techniques with the specifications imposed on the producer by the purchaser. The steel castings being dealt with will be classified in the following groups:

- Plain carbon steels specified by chemical and minimum tensile properties,
- High strength steels specified by minimum tensile properties, for miscellaneous uses where requirements do not justify hardenability control.
- High strength steels specified by minimum tensile properties and hardenability requirements.

Chemical requirements for steels so specified, it is tentatively planned, will be given

in terms of maximum phosphorus and sulphur content. Physical properties, the Committee proposes, will be checked by tensile tests, radiographic and magnetic particle inspection, and hardness tests.

Hardenability Determination

With the increased tendency toward hardenability specification in ordering of steel castings, hardenability factor determination has been singled out as an important factor. The degree of hardenability required in a steel depends largely upon the type of service and may vary from deep-hardened steel – full quench hardness to the core – to a shallow hardened steel.

To allow for these varying requirements, the Committee is developing a method for determining the relationship of the thickness of the section on the casting hardened by heat treat with the hardness attained in the Jominy bar test performed in the foundry. The critical operation in the heat-treat process, which this technique attempts to control, is the quenching and cooling. Greater experience in dealing with the hardenability factor is needed, the Committee feels, before this method can be considered fully effective and practical.

In addition to the above elements, to be included in the proposed standard are fusion welding of castings, repair of defective castings in the foundry and the machine shop, marking, finish, and procedure for handling of rejections.

Handbook Expanded on Non-Metallics

UTILITY value of the SAE Handbook has been further enhanced by the SAE Non-Metallic Materials Committee through revisions and additions of rubber classifications and hose specifications reflecting up-to-date industry practice.

Specifications for the four following types of automotive fuel and oil hose were prepared by the SAE-ASTM Technical Committee A on Automotive Rubber and approved by the SAE Non-Metallic Materials Committee for inclusion as a Recommended Practice in the 1946 edition of the Handbook:

1. Metal-lined hose, coupled,
2. Synthetic rubber tube and cover, coupled and uncoupled,
3. Braided reinforcement lacquer or cement covered hose, coupled or uncoupled,
4. Synthetic rubber, wire reinforced, circular woven type with lacquer cover.

A new standard adopted by the Committee covers natural rubber cups for hydraulic actuating cylinders. Among the present items in the Handbook brought up-to-date are the sections on coolant system hoses and classifications and physical requirements for rubber compounds.

A project on hydraulic fluid specifications has undergone considerable study by the Committee, under the chairmanship of W. M. Phillips, General Motors Corp., and is in the final stage of completion. To make the proposed specification available to industry and the general public as soon as possible, it will be issued, when completed, as an SAE Recommended Practice.

SAE Student Branch News

University of Colorado

The University of Colorado Student Club, in conjunction with the SAE Colorado Group, held a meeting on May 9 at the University.

Demonstrations in the Mechanical Engineering Laboratories of the University were put on by the students. They included testing of automobile and diesel engines with dynamometers; testing of various octane ratings of fuels on a single-cylinder high compression engine; dynamometer tests of an aircraft engine; tests of an airplane model in the wind tunnel; tests of steam engines, pumps, steam turbines and air compressors and displays of cut-away models of several automobiles, engines, magnetos, fuel injection pumps and carburetors.

University of Detroit

At a business meeting on April 29, the University of Detroit SAE Student Branch elected officers for the 1946-1947 term. The newly elected officers are: chairman, Charles Goodyear; vice-chairman, Edmund Walsh; secretary, S. N. Shantz; treasurer, Edward Kowalski.

University of Oklahoma

On April 23 the University of Oklahoma Student Branch held a meeting at which Donald Malvern spoke on "Fighting Aircraft Induction Fires." Mr. Malvern was awarded a year's membership in the Institute of Aeronautical Sciences for presenting this paper to the Student Branch of that Society on April 16, 1946.

Carl A. Tangner, Road Equipment and Supply Co. and the Diesel Power Co. of Oklahoma City, was the principal speaker of the evening. The subject of Mr. Tangner's talk was, "When Will Atomic Energy Replace Diesel Power?"

Visiting members of the SAE present at the meeting, in addition to Mr. Tangner, were George W. Cupit, Jr., chief chemits for the Oklahoma Corporation Commission, Oklahoma City and H. R. Grigsby, superintendent of transportation for the Oklahoma Gas & Electric Co., Oklahoma City.

New officers were elected for the following school year. Walter Cralle was voted chairman, Oren Jackson, vice-chairman, and Joseph Wilson, secretary-treasurer.

University of Wisconsin

The main business of the March 26 meeting of the University of Wisconsin Student Branch was the formal introduction of the newly elected officers which are as follows: chairman, Arthur Schmitt; vice-chairman, John Thuermann; treasurer, Jack Hinkley; secretary, Kay Nakagiri.

The Student Branch Chairman spoke on the semester's forthcoming activities.

College of the City of New York

On April 10 the CCNY SAE Student Branch heard an address by F. R. Nail, assistant to the chief engineer of the Mack Truck Co., on "Truck Design and Development."

Mr. Nail listed the three prerequisites in truck design as efficiency, utility and public opinion. The latter is especially important for if the public fears the truck on the road, it will enact legislation further restricting truck development. He limited the top speed of future trucks to 60 mph. Above that speed the drag increases at such a rate to make economical operation impossible. Mr. Nail supplemented his talk with performance curves and illustrations of futuristic designs.

On April 22 the SAE Student Branch at CCNY visited the Propeller Division of Curtiss Wright Corp. at Caldwell, N. J. The trip began at 10 a.m. with a briefing as to the nature of the Curtiss electric propeller and its reverse thrust and full feathering features. The group was then escorted in parties of four and five through the plant. There they saw the hollow steel blades being milled, pressed, welded, machined, balanced and inspected. Students were conducted on a tour of the test cells, engineering laboratories and airport. This was the first group to visit the Caldwell plant since the start of the war, and they were very appreciative of the honor bestowed upon them.

General Motors Institute

The SAE Enrolled Students at General Motors Institute visited the Saginaw Malleable Iron Foundry on April 23. Various members of the foundry's technical staff, among them a GMI graduate, were on hand to take the boys on guided tours throughout the plant.

The high spot of the tour was watching the operation of the cupolas. The boys were shown how these great furnaces were loaded with pig iron and fuel; how the huge blowers operated to supply the draft of pre-heated humidified air which supported combustion in the cupolas and finally, how the white hot malleable iron, sparkling and sputtering furiously, was drawn off into pouring ladles. Also intensely absorbing were the processes of pouring and shaking out the molds, making the intricate cores, heat treating and finished castings, and the Brinell test inspection.

The trip through the plant took approximately two hours, and it was followed by a questioning period in the conference room.

Massachusetts Institute of Technology

The Allis-Chalmers motion picture, *Tornado in a Box*, was shown at the April 24 meeting of the M.I.T. Student Branch.

Prof. E. S. Taylor delved into some of the technical properties of turbo jets in his talk following the picture. He described the turbo jet as the most simple of the prime movers, a property which it possesses

to a far greater degree than does the internal combustion engine. Another advantage it has over the internal combustion engine is that it does not require a place to put the heat. The elimination of the propeller in the jet permits higher speeds. The jet, however, still presents many difficulties to the engineer. Thrust at take-off is not as high as desired. This necessitates a long take-off run. The other important difficulty is that of cutting down fuel consumption. Professor Taylor is confident that with further research, these difficulties will be surmounted.

On May 7, the M.I.T. Student Branch acted as host to the New England Section at a joint meeting held at the Institute.

John A. C. Warner, secretary and general manager of the Society of Automotive Engineers, delivered a review of Society affairs which was enlightening to everyone present.

The motion picture, *Diesels Working on the Railroads,* was shown through the courtesy of General Motors Corp., and was followed by a talk by Ernest K. Bloss, supervisor of diesels, Boston & Maine Railroad. Mr. Bloss was very enthusiastic in his praise of the Diesel engine, especially the two-cycle type in current use. He showed the advantage of the Diesel in providing smooth starts. The Diesel, with its steady application of power, is very much more efficient at low speeds than is a steam engine of greater horsepower, which engine requires a speed of approximately thirty mph to come to its maximum efficiency. Diesels used in short hauls about rail yards are in use 95% of the time (considerably more time than the steam engine) because of easy maintenance. Here Mr. Bloss commended the designers of the Diesel. There is no need for a complete overhaul of the engine. A few pistons may be changed now, and a few next week, without taking the whole engine apart. The only really difficult problem is that of the maintenance of the electrical system, which is rather complicated. However, this same electrical system permits the saving of wear on brake shoes and wheels on hills by providing a braking effect, the heat being dissipated through the roof of the engine rather than being dissipated in the form of friction. Diesels are coming into wider use as freight haulers (B & M has quite a few). These freights, together with the speedy streamliners pulled by Diesels, will keep the railroads in business for a long time to come.

Oregon State College

A joint meeting of the SAE and ASME Student Branches at the Oregon State College was held on April 18.

Mr. Allen, a safety engineer with the Bonneville Power Administration, gave a talk on automotive and industrial safety. The SAE officers were in charge of the meeting.

Purdue University

On April 18, the Purdue University Student Branch held a reorganization meeting at which Prof. H. C. Buttner gave a talk on "What Industry Expects of Engineers." He explained some of the problems encountered by engineering graduates when they go out into industry, and illustrated his points with numerous personal experiences.

Newly elected officers are: chairman, James Low; vice-chairman, John Schauble; secretary-treasurer, Floyd R. Kishline.

Ramblings

cont. from p. 35

A CLEVELAND SECTION questionnaire recently brought to light a general desire for more specific, somewhat more technical meetings papers for that Section. . . . Speaker at the March 14 meeting was Col. Norman L. Winter, Communications Officer for the Air Technical Service Command, who reported on "AAF Radar in Combat." Col. Winter commented on the outstanding success of radar in view of the short time available for its development. As an indication of radar's value in the bombardment of shipping, he reported that planes not equipped with radar sank 126 tons per ton of bombs, while radar-equipped aircraft sank 476.

Diesel Engineering meeting of SOUTHERN CALIFORNIA SECTION, April 5, was held in the Education Building of the University of California. First speaker was Dean L. M. K. Boelter of the Engineering College, who asked, speaking of Engineering College plans, how many engineers with different degrees can industry absorb each year, can industry make arrangements to

take care of students to work in industry during their academic careers, and what is the engineering graduate's prospect immediately after graduation. The Dean introduced Carl James Vogt, professor of mechanical engineering, who reported his observations on a recent tour of active duty with the Naval Technical Mission. In a number of instances, he said, the Germans were able to use sucessfully practices long ago given up and discarded by us. He believes careful handling will gain cooperation from most German engineers and technicians, since most hold professional pride above political ardor. German engineers, he said, often find more real solutions to their technical problems by going beyond handbooks, back to basic facts.

Opening the April 19 meeting of **SOUTHERN CALIFORNIA SECTION,** Chairman Gerthal French announced that Southern California Section membership is rapidly approaching the 1500 mark. Featured speaker was Joseph F. Manildi, chief research engineer, G. M. Giannini & Co., Inc., whose subject was "The Theory of Operation and Fields of Application of the Turbo-jet, Ram-jet (Athodyd) and Pulse-jet." Discussion period brought out that: a jet engine can safely be throttled down 30% from its peak performance; any of the three types could be used for helicopters, but pulse-jet probably will be tried first; and pulse-jet and ram-jet engines can operate up to a 15-to-1 A/F ratio, equal to about 5000 R.

"Where angels fear to tread, the proponents of plastics will walk willingly," **DETROIT SECTION** was told at its April 8 meeting by Eugene Vidal, president of the Vidal Research Corp. and Aircraft Research Corp. Mr. Vidal discussed the many types of resins and various methods of fabricating compound curved surfaces which are so prevalent in automobile bodies. Prepared discussions covered design criteria, thermosetting plastic adhesives, fibrous felts and ethyl cellulose plastic derivatives.

"Future Automotive Possibilities" will undoubtedly encompass numerous improvements in engines, transmissions, cooling systems, suspensions, and so on, according to Austin Wolf, automotive consultant. Speaking before the **PHILADELPHIA SECTION,** April 10, Mr. Wolf showed how some of the recent improvements made in passenger cars are merely improvements or modifications of former designs used in the earlier years of automotive vehicles.

Present textbooks make engineering appear too simple, according to J. O. Almen, Research Laboratories Division of General Motors Corp. Speaking before **WESTERN MICHIGAN SECTION,** April 25, Mr. Almen said that knowledge of a slide rule and how to apply the laws of mechanics and formulas does not make an engineer, since theory does not always correlate to practice. As an example, no automobile company has yet produced a new design which has not given trouble in some part of the service field no matter how perfect dynamometer and proving ground showed it to be. Continuing his talk on "Correlating Laboratory Test with Service Performance," he showed slides which illustrated the problems involved in reproducing field failures in the laboratory.

"Once Over Lightly on Automotive Brakes," presented at **SYRACUSE SECTION'S** April 25 meeting by Frank Holman, Bendix Aviation Corp., comprised a review of the basic mathematical background of brake performance and a description of various types of brakes which have been developed to accomplish desired results.

Dealing uniquely with the social aspect of the human race, resolving the result of human activity into a mathematical formula, SAE Past-President H. C. Dickinson's talk before **WASHINGTON SECTION,** April 11, aroused unusual interest. Dr. Dickinson, who is retired from the National Bureau of Standards, spoke on "Science and Engineering Won the War, Why Should They Not Keep the Peace?"

Headache for designers is the extreme complexity of present highway regulations, which, W. D. Owsley reported to **MID-CONTINENT SECTION,** March 22, are based largely on highway characteristics of 20 years ago. Speaking on "Problems of Special Motor Vehicle Design," Mr. Owsley, who is chief engineer for Halliburton Oil Well Cementing Co., outlined these problems, described the governing influence of highway laws, and suggested improvements.

Fueling Gains New Problems

Digest of paper

by RUSSELL M. SECREST

Pan American Airways

■ So. California, Oct. 4

(Paper entitled *"The Operator's Fueling Problems"*)

FUELING problems are not just the responsibility of airline operators, in Mr. Secrest's opinion. Three vital design objectives of *safety, efficiency* and *economy* are a matter for the cooperative ingenuity of airframe manufacturers, airport equipment manufacturers and operators.

New problems are introduced, he said, by larger planes, sleeper versions, higher wings, and other innovations requiring speedier, safer fueling. En route refueling of sleepers will require more than ordinary diligence on the part of fuel crews in watching ground facilities and procedures for safety. Increased size and higher wings imply improved underwing facilities for safety.

Faster schedules with longer hops probably will require loadings of 5000 gal or more at the origin, 2-3000 gal at intermediate stops, so that a per hose rate of 150-200 gpm is advisable.

Other immediate fueling needs include:

- Dry hose method with self-sealing couplings to eliminate fire hazard.
- Adequate safety devices, and careful location of tank vents to avoid trapped fuel vapor in the wing area.
- Accurate fuel gaging, since fuel aboard is more relevant in computing payload than fuel loaded at any particular stop.
- Fueling pits with hydrants and a jeep booster unit, to eliminate hauling of heavy equipment and the congestion coincident with the truck method.

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New Demands Revise Brake Design Methods

Excerpts from paper

by STEPHEN JOHNSON, JR.

Bendix-Westinghouse Automotive Air Brake Co.

(Paper entitled *"Brakes: Fundamentals, Design and Performance"*)

Mid-Continent, Dec. 7 — Salt Lake, April 1
St. Louis, March 12 — Northwest April 5
Baltimore, March 14 — Spokane, April 9
Oregon, April 12

IN recent years, improvements in operating practices have changed the underlying trend in air brake development. It is no longer a matter of effecting changes so that the air brake equipment itself will function more uniformly and satisfactorily, but of meeting requirements established by new demands for improved overall braking performance. To satisfy such demands the entire braking system must be considered and the action of all elements coordinated so that maximum efficiency can be obtained from the proper correlation of all the interdependent parts.

The most notable accomplishments in the field of brake engineering during the past few years have been not the many ingenious power brake devices developed, but the establishment and exposition of fundamental principles resulting in a better appreciation and utilization of the possibilities of power brake apparatus for increasing the convenience, economy, and safety of modern transportation.

The advantage of being able to utilize the adhesion of all the tires in the train of vehicles is obvious; the poorest brake performance has been so good in comparison to that of engines, transmissions, and so on, that its necessities and possibilities have been quite generally accepted as long as the principles of interchangeability and reasonable uniformity in making repairs were maintained.

It is very seldom that we hear anyone boasting about the horsepower of brakes and the rate at which the vehicle can be slowed down or stopped, although it is at least as important as rapid acceleration. We can safely say that brakes are 10 times as powerful as the engine, since they can stop a vehicle from 60 mph 10 times as fast as the engine can accelerate it to this speed, without serious injury to the braking system or to the vehicle itself.

The real work is done by the brake lining rubbing against the brake drums attached to the wheels, changing kinetic energy into heat energy. When the weight of a moving vehicle is doubled, the kinetic energy at all speeds is also doubled. Since heat is the enemy of brake lining and drums, it is necessary to have larger brakes with better lining and drums whenever the vehicle weight is increased. And, since kinetic energy varies as the square of speed, brakes must be four times more efficient for operation at 40 mph than for 20 mph.

Considering the tremendous amount of work which modern brakes do, the high heats under which they must operate, and the great power demanded of them, it seems remarkable that they perform as well as they do, considering the relatively small amount of care and attention they get. Brakes are located in positions which expose them to all the dirt and water splashed from the road by the tires, but to very little cooling air. Braking systems sometimes have the correct amount of oil and grease in the correct places, but most often they have insufficient lubrication on sliding contacts, too much oil or grease in places where it does not belong, such as lining surface.

Road friction, the static friction responsible for brake action, increases with the difficulty the tire finds in revolving, but cannot increase indefinitely. After road friction reaches a certain value, the wheel ceases to revolve and slides. The ratio of this limiting value to the weight on the road is called the coefficient of adhesion. Thus, if the coefficient of adhesion is 60%, the road friction or retarding force cannot exceed 60% of the weight carried by the wheel.

Therefore, the coefficient of adhesion fixes the maximum retardation which can be employed . . . road surface and tire limit the shortest stopping distance, not the brake. If wheels are to revolve throughout the stop, the coefficient of adhesion must not be exceeded.

Important operating developments of recent years which have aggravated the brake problem are higher operating speeds requiring increased stopping ability; larger sec-

tion, smaller rim diameter tires increasing cooling problems and limiting brake drum diameter; and legislative limitations on over-all width cutting down space for adequate brake drum and lining width.

It is generally agreed that satisfactory brakes on heavy-duty vehicles should include these features of design:

1) Brakes on all wheels.
2) Internal construction.
3) Power to obtain the pressures necessary to stop the vehicle with comfortable effort on the part of the operator.
4) Alloyed cast-iron drums for best results now possible.
5) Molded material for brake lining, softer than the drum and in easily replaceable form.

The ability of brakes to absorb the moving energy transformed into heat without a destructive rise in temperature at the working surfaces depends on the effective braking area provided. Therefore, the prime consideration is the total weight on each wheel of the vehicle and the effective area of the friction material: the weight-area ratio. Experience has indicated that brake lining wear is closely proportional to the weight-area ratio.

From the vehicle makers' and the operators' point of view, there are two major requirements for brake lining. These are wear life and constancy of friction value during the wear life under all conditions of operation. For maximum economy, efficiency, and safety, the vehicle actually should be built around the brake installation. A proper brake design and installation must include certain well defined provisions, and if they are not possible of incorporation after the vehicle has been designed, the brake efficiency will suffer accordingly.

A satisfactory brake must possess reliability, flexibility, and effectiveness. Reliability depends upon correct design and reasonably good maintenance; flexibility involves an extension of time in which to obtain predetermined braking forces up or down, the extension of time being a function of the range between no braking force and maximum braking force; effectiveness involves the maximum degree of braking force with flexibility requirements as previously mentioned and elimination, as far as possible and practical, of the time required to transmit the pneumatic application from the cab of the tractor to the rearmost axle on the end of the last trailer in the train.

We are about to enter into an era of better brakes for highway transport vehicles. We should broadly view the brake part of the modern motor vehicle. We should consider not how quickly or in how short a distance we can stop a vehicle, but in how short a distance the vehicle can stop with safety. There are many things besides the operating devices themselves that play an important part in the operation of the brake as a whole; cooperation or teamwork by all concerned is vital, to the end that all parts and conditions affecting the operation of the brake should receive due care and consideration. Returns make it worth while.

Postwar Highways Gain By Functional Planning

Excerpts from paper

by FREDERICK C. HORNER
General Motors Corp.

▪ New England, Jan. 15

(Paper entitled "Postwar Highway Transportation Problems")

THE fundamental problems of postwar highway transportation are those of volume and speed. The other problems are largely subsidiary to these. In approaching the solution of these problems, we must have regard not merely for suitable design and construction of roads and vehicles, but equally for the proper training and cooperative conduct of all road users, to reasoned segregation and skilled control and direction of traffic, and to wise legal regulations and enforcement of the law.

We must attack on a fundamental basis. It is the disease, not the symptom, on which we must concentrate. To accomplish the objective will cost money, and, even more important, the highway user and those served – both individually and collectively – must be willing to sacrifice certain practices and conveniences now enjoyed.

The situation is so serious that we cannot afford to procrastinate in dealing with it.

American road construction in 1946 will total $650 million according to a recent estimate by the Federal Works Agency, increa-

ing to two billion annually by 1949, when it will level off. Added to this will be roughly one billion expended annually for highway debt service, maintenance, administration and other relatively fixed expenditures. The total program, therefore, is expected to reach three billion annually after about four years. Federal-aid funds authorized by Congress for highways total $500 million annually, about one-fourth of the estimated construction expenditures and one-sixth of the total highway budget.

Federal-aid funds are apportioned among the state according to formula specified by law, and matched dollar-for-dollar by the states to finance projects on Federal-aid road systems approved by the U. S. Public Roads Administration. The 1944 Act gives heavier weighting to the population factor of the formula than previous legislation.

New approach is the earmarking by Congress of definite percentages of these funds for the various road classifications. The December, 1944, law earmarks $125 million of each year's authorization for projects in urban areas; $150 million for the principal secondary routes (farm to market roads), and the remaining $225 million for the regular Federal-aid system, which embraces the main trunklines, both urban and rural.

Master Plan

The program will be accomplished over the next quarter of a century. Design standards have been approved for each mile of road in the various systems which take into account future traffic requirements during the life of the highways. This is a vital part of the program . . . to protect the highway plant investment against the penalty of early obsolescence.

There probably will be some State Highway User Tax increases, some borrowing, but revenues based on mileage of use will increase with increasing traffic volume.

Cost of highways is only one of the problems; the truly serious problem in the field is accidents. Unless, through voluntary action on the part of users, combined with such public controls as now exist, we can bring about a material reduction in highway accidents in this country, we are faced with the problem of some drastic restrictions on the highway user. Building safety into the highways is one of the basic reasons for making highway improvements.

Regarding regulation and control of commercial motor transport by Federal and State agencies to bring about integration of transportation facilities, I would recommend

1) Regulation confined to the public interest and the development of adequate transportation facilities, not for the benefit of competing forms of transportation.

2) Permitting any form of transportation to operate any other form to the extent necessary to enable it to give a more complete service.

3) Joint rates in preference to duplicate service, where economy and better service will result.

4) More equitable handling of size and weight limitations than in the past.

Preservation of the principles which have made America the greatest and most progressive nation in the world depends in large degree upon a quick recovery and continued development in agriculture, industry and transportation. Highway transportation again will take its place as one of the top employers of persons and users of production facilities and raw materials, provided its untrammeled development is fostered by sound laws and regulations.

APPLICATIONS Received

The applications for membership received between April 10, 1946, and May 10, 1946, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

Baltimore Section: Joseph Arthur Edwards, Jr., Frank Goodwin Hubbard.

Buffalo Section: William R. Green.

Canadian Section: Thomas Roy Banbury, L. F. Barnes, Donald M. Chisholm, Raymond J. Dean, Howard C. Glunz, F. R. Stephens, Lawrence Cotter Thomlinson, Lawrence Torgis.

Chicago Section: Stanley R. Brod-

head, Francis E. Edwards, Otto R. Hills, Maynard J. Larkins, Walter J. Metzger, C. A. Richards, Henry W. Schmidt, Eugene C. Sutton, Donald Leroy Whitehouse.

Cincinnati Section: William L. Mappes, Gustav F. Windgassen.

Cleveland Section: Wilbur E. Crink, Charles M. Kitson, Cearcy D. Miller, John L. Mueller, William Fredrick Perkins, Albert O. Ross, Earl D. Watson.

Detroit Section: John D. Bailie, Richard L. Ball, Theodore Bargman, Harold C. Barringer, Harry W. Brown, Arthur W. Bull, Walter A. Clouser, Robert E. Decker, Frank J. Denny, Woodrow W. Eargle, Allen F. Edwards, Jr., R. Dean Engle, E. Edwin Ensign, Alfred G. Gorski, Hugh William Harris, Sam C. Hunt, Walter A. Jensen, Richard L. Kellogg, Charles James Murray Mason, Ensign Merle Wayne McLaughlin, Robert C. Ofenstein, Wilmoth S. Respess, Herbert H. Ruhl, C. Gordon Sinclair, Walter Eugene Swigart, John Taylor, A. K. Tice, Robert Brewster Webber, William F. Zack.

Dayton Section: H. Hudley Wright.

Hawaii Section: Elmer Richard Bolles, N. R. Dawley, J. T. Elliott, Jr., Chester E. Frowe, G. Rae Meisner, Richard H. Miller, Byron B. Peetz, Lyle N. Petry, W. P. Sheehan, Charles J. Weaver, Robert S. Wilson.

Indiana Section: Howard Alton Eilar.

Kansas City Section: Kwang-Chen Chow.

Metropolitan Section: J. V. Bassett, Charles F. Block, James R. Bright, Morris Davidoff, Patrick A. DeVincenzo, John E. Dickson, Harold L. Ehlers, Russell W. Gregory, Haworth William Hurt, George E. Kellis, James Maxwell Langley, Robert L. Lohman, Raymond J. McGowan, George Washington Morrison, John James O'Donnell, Chester Charles Pearson, Anthony Phillips Pennock, Thomas D. Rae, Edward Duer Reeves, Jacob F. Reith, Lt.-Col. James A. Richardson III, Joseph M. Sills, Edward E. Smith, John T. Tepley, William R. Toeplitz, Pierluigi Torre, Theodore Vandervliet, Frank T. Ward, Marshall G. Whitfield, Charles A. Wolf, Charles Francis Wunderlin.

Mid-Continent Section: James E. Martin.

Milwaukee Section: Robert Ewald Hoffmann, Arnold F. Meyer, Jr., Martin Spencer.

Mohawk-Hudson Group: John Howe, Capt. Philip J. Hummel, Edmund H. Turnau.

New England Section: Jesse R. Boyle.

Northern California Section: Ned Cornelius, E. A. Ross Dillon.

Northwest Section: W. O. Harvey, Paul Kermit, Lewis G. Newlee, B. J. Sears, Joseph W. Tubbs.

Oregon Section: John M. Barnes, John H. Bollons, George Edmond Fisher, Edward E. Johnson, John S. Larison.

Peoria Section: Charles F. Elder.

Philadelphia Section: Donald L. Grader, Ernest Lloyd Korb, S. F. Niness, Ernest M. Schneider, S. R. Zimmerman, Jr.

Pittsburgh Section: Robert P. Gilmartin, Charles L. Kent, Court L. Wolfe.

Salt Lake City Group: James Harry Shafer.

Southern California Section: Phil S. Adams, George Edwards Agnew, Charles W. Anderson, Jerry C. Barker, Paul M. Bollinger, Richard E. Bolton, G. Robert Brainard, Henry Elmer Brink, William H. Bulen, Dan B. Chapman, Willard W. Comstock, D. DesLauriers, Claude E. Evans, Melvin Fisk, Paul C. Gomez, J. Richard Foster, Richard Gilman, Joe Boucher Hartley, Julian R. Hedding, Charles N. Hicks, Houston C. Hunt, Robert R. Janssen, Lt. (jg) Albert E. Kent, Jr., Russell William Lamb, Monroe Seymour Levy, George H. Lindsey, Donald B. Mackay, Walter Osborne, Michel C. Palmer, Edwin A. Pecker, Herbert M. Place, Charles Alfred Richey, Glenn G. Shafer, Fred William Segerstrom, William Beal Shaw, Joseph Stephen Skurky, Gardner W. Stevens, James Stronach Stoker, Jack Strauss, Ben Sturm, Tom Urban, F. B. Wasserboehr, Norman Wigney, William Douglas Wilmott, Roy Wright.

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NEW MEMBERS Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between April 10, 1946, and May 10, 1946.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (SM) Service Member; (FM) Foreign Member.

Baltimore Section: Harry R. Annesley, Jr. (J), Thomas E. Swartz (A).

Buffalo Section: Eames Donaldson (M), John Robert Fogarty (A), Walter G. Lautz (J), Albert L. Preston (J).

Canadian Section: British American Oil Co., Ltd. (Aff.) Reps: Peter Leonard Paull; C. D. Read. Karl R. Chalmers (A), John Gelb (M), Maurice Henry McCurdy (M), Rowland Pepper (A), Norman Stone (A), Albert Edward Weightman (A).

Chicago Section: Raphael Angelini (J), J. Dana Brown (A), Charles R. Eulo (J), Charles E. Harnach (A), Harold J. Hlavka (M), William R. Mogg (A), Frank M. Moyes (A), George Wm. Oehlsen, Jr. (M), Richard A. Peterson (J), Don C. Slamer (M), William Steinwedell (M), Capt. A. L. Van Nest (SM).

Cincinnati Section: Howard A. Bischoff (A), Harold B. Frye (M), R. K. LeBlond Machine Tool Co. (Aff.) Reps: B. N. Brockman; Harold J. Siekmann. Chas. A. Simpson (A).

Cleveland Section: Thomas William Jarrett (J), James R. Lee (A), Ralph J. Poole (A), Frank L. Suozzi (J), Jack M. Wagner (J).

Colorado Group: Elmer John Sellinghausen (A).

Dayton Section: Arnold L. Johnson (SM).

Detroit Section: John V. Barnes (J), Lawrence W. Becker (M), Ernest R. Breech (M), Rinehart S. Bright (M), David H. Brown (J), J. Arthur Brown (J), Felix Carl Bugnell (M), Frank T. Cox, Jr. (M), Harry W. Dale (A), Jack G. Deakins (J), Raymond O. Doss (M), William Harris Downer (J), Robert King Hirchert (J), Thomas L. Holbrook, Sr. (M), Charles F. Hoopes (A), Clarence F. Kramer (M), Melvin Eugene LaVerne (J), Prentiss B. Leffler (A), Thomas J. McIntosh (A), Robert J. Meier (A), Bennie D. Mirkin (J), Nelson S. Mosher (A), Frank A. Newberry (J), Wilbur D. Osborne (A), Norman K. Reinhard (SM), Wm. E. Rigley (M), Saul H. Rose (A), Nathan H. Schermer (M), Walton H. Schuh (A), Ted M. Scott (J), Daniel A. Sherick (M), Walter D. Speicher (A), John A. Swint (J), Baxter Webb (J), Herbert C. Wendt (M), Joseph A. Zoehrer (A).

Hawaii Section: Walter Roy Blake (A), A. J. Hebert (M), John Colwell McLaughlin (A), Robert L. Muller (A), Arthur C. Neely (M), F. E. O'Rear (A), E. J. Sairniman (M).

Indiana Section: Emil C. Iverson (M), Jack William Wackerbarth (M).

Kansas City Section: Al. Stratton (A).

Metropolitan Section: Edward Vernon Albert (J), 1st Lt. Robert C. Allen (A), Alphonso C. Capparelli (J), William Irving Drumpelmann (M), Fred R. George (A), Ensign Norton B. Jamieson (J), Melville D. Johnson (M), Frank John Kinder (A), Geo. A. Martin (A), Charles Milesi (A), Clark J. Moody (A), Frank A. Pallone (J), Bretislav Prochazka (M), Gustave Joseph Rauschenbach (M), Joseph Harry Rosenberg (J), Charles L. Seelbach (M), Allen Shaw (J), Waldes Koh-I-Noor, Inc. (Aff.) Reps: Heinrich Heimann; Harry T. Wines. Donald Frederick Suppes (J), Orrin E. Watson (J), Frank H. Woodman (A).

Mid-Continent Section: Richard Todd Agster (J), Ed. Renier (A).

Milwaukee Section: John W. Bonneau (M), Alfred A. Wridt, Jr. (J).

New England Section: Urban J. Long (A), Charles H. Newton (A), Otis W. Rose (A).

Northern California Section: Sydney R. Calish, Jr. (J), John W. Eaton (A), Nathan David Jacobson (A), Robert J. Rice (A), George W. Walker, Jr. (A), Clarence W. Winther (A), Lt.-Col. Walter W. Woodard (SM).

Northwest Section: John Conti (A), C. H. Erlandson (A), Walter N. Jameson (A).

Oregon Section: Scott Chandler (A), Julius Gaussoin (A), Joe M. Walyer (A).

Peoria Section: Woodrow P. Kimsey (J), Burton Rich Miller (J).

Philadelphia Section: Joseph Brennian, Jr. (A), Lt. Louis Harold Cargill (A), Francis H. Gibson (A), Arthur N. Holroyd (A), W. C. A. Johnson (A), Russell H. Kent, Jr. (J), Dale Henry Rauch (J), Gordon F. Shandley (A), Norman S. Waner (J), Clifford J. Ulzheimer (J).

Salt Lake Group: Robert Kirsch (A), Earl S. Phillips (A).

Southern California Section: Michel Ambroff (M), Emil C. Carlson (A), Lt. Walton L. Carlson (J), James Frederick Cook (M), Charles A. Dow (A), William R. Hodge (J), H. W. Looff (A), Herman Van Dien Stewart (J), John W. Tucker (A).

Southern New England Section: John Boyle Cray (J), Russell M. Lipes, Jr. (J), Frederick C. Reed (M), Emanuel A. Weiss (A), Gordon T. Williams (M).

Spokane Group: Chester F. Coleman (A), John Lewis Peters (A), Homer L. Rouse (A).

Syracuse Section: Claude M. Bigelow (A), James E. Midkiff (J), Robert S. Root (M), Alexander E. Weaver (M).

Virginia Group: George W. Aron (A), Charles Garland Dillard (A), James Alfred Pettit (A), Richard L. Smith (A).

Washington Section: Richard A. Brown (A), Kenneth Phillip Forman (FM), A. Edward McGarry (SM), Major Kenneth V. Shane (SM).

Western Michigan Section: George C. Andreas (M), Rehmert W. Clark (A), William F. Hayes (A).

Wichita Section: Virgil H. Adamson (M).

Williamsport Group: Ralph S. Wilson (J).

Outside of Section Territory: Edward Halket Allen (J), Dwight Moody Dellinger (A), Benjamin S. Horton (M), Richard W. Logan (M), J. Brent Malin (J), John M. McCollister (A), Edouard Morris (M), George H. Sites (A), Edgar F. Speiden (M), Lt.-Col William C. Wine (A), Robert D. Winkelmeyer (M).

Foreign: Leonard Ainsley (FM), (England); Eric Maximillian Bosson (A), (England); Cecil Chilvers (FM), (England); Victor Henry Frederick Hopkins (FM), (England); Benj. King (FM), (England); Douglas Charles Neaves (J), (England); Bertram Jacob Tams (FM), (England).

Applications Received

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Southern New England Section: Stephen M. Truex.

Spokane Group: Ray A. Wager.

Syracuse Section: Richard W. Stewart, James J. Wilder.

Virginia Group: Sol Axel, Sam Greenberg, Joseph Michael Kelleher, Oscar S. Ward, Charles Hamilton Woodward, Jr., Charles Hamilton Woodward.

Washington Section: Francis Vernon Allen, Hobart S. White.

Western Michigan Section: Robert K. Stevenson.

Wichita Section: Lyonal N. Copeland, J. W. Lancaster, Ralph William Neiberger, Donald C. Simon, Marshall Leroy Werth.

Outside of Section Territory: W. Howard Bradshaw, Charles Hanna, Harold Puxon, Edward B. Van Voorhees.

Foreign: Pierre Cibie, France; Gaetan de Coye deCastelet, France; Charles Lindsay Goodacre, England; Henry Hirst, Australia; Frederick Darnton Hollister, England; Ivan Henry Versfeld, South Africa.

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